Attachment A

CONDITION SECTION - ASK ONLY ABOUT CONDITIONS ENTERED ON CONTROL CARD IN ROUND 3 -- i.e., BELOW LAST REF. DATE. IF NO CONDITION, GO TO SUMMAKY.

Cond. # _____ Person # _____ First Name: _____

1. PRINT NAME OF CONDITION: _____

You said earlier that (PERSON) had (CONDITION).

IF CONDITION #1, SKIP TO Q. 3.

2. IS this (CONDITION) related to the (NAME ALL CONDITIONS LISTED ABOVE THIS CONDITION ON CONTROL CARD) that you told us about (in a previous interview)?

Yes . . . . . 01(A)
No. . . . . 02(3)
Don't know. . . . 94(3)

A. Which ones? #_ #_ #_ #_

B. Is this (CONDITION) the same condition as (RELATED CONDITIONS)?

Yes . . . . . 01(C)
No. . . . . 02(3)
Don't know. . . . 94(3)

C. Which ones? RECORD AND SKIP TO NEXT CONDITION.

#___ #___ #___ #___

IF "Never" IN Q. 3, TRANSCRIBE ENTRY FROM Q. 1 TO Q. 4.

4. What did the doctor or other medical person say It was--did he give it a medical name? _____

EXAMINE ANSWER TO Q. 4 AND CIRCLE APPROPRIATE CODE:

Cancer . . . . . 01(7)
On Card C. . . . . 02(8)
Nefther. . . . . 03(4)

A. What was the cause of (CONDITION)? _____

Accident or iujury. . . . . 01(11)

1. When dld (PERSON) last sea or talk to a doctor or other medical person about his (CONDITION)?

Before Jan. 1, 1976. . . . . 01(A Box)
Never. . . . . 02(A Box)
_____/_____/_____ (A)
Month / Date / Year

A. Did (PERSON) see a doctor or other medical person about his (CONDITION) before January 1, 1977?

Yes . . . . . 01(A Box)
No. . . . . 02(ABox)

IF ENTRY IN Q. 4 OR 4A INCLUDES ANY OF THE FOLLOWING WORDS, ASK Q. 5

Ailment	Attack	Defect	Growth	Trouble
Anemia	Condition	Disease	Measles	Tumor
Asthma	cyst	Disorder	Rupture	Ulcer

5. What kind of (WORD) is it? _____

IF ALLERGY OR STROKE, ASK Q. 6.

6. How does the [allergy/stroke] affect (PERSON)? _____

IF IN Q'S. 4, 5, OR 6, THERE IS AN IMPAIRMENT, OR A PART OF THE BODY IS MENTIONED, OR ANY OF THE FOLLOWING 'ENTRIES, ASK Q. 7.

Abscess	Cancer	Hemorrhage	Palsy	Ulcer
Ache (except head or ear)	Cramps (except menstrual)	Infection	Paralysis	Varicose veins
Bleeding	cyst	Inflammation	Rupture	Weak
Blood Clot	Damage	Neuralgia	Sore	Weakness
Boil	Growth	Neuritis	Soreness	
		Pain	Tumor	

7. What part of the body is affected? BE SPECIFIC. _____

A BOX

EXAMINE "NAME OF CONDITION" AND CIRCLE APPROPRIATE CODE.

Accident or injury . . 01(11)
On Card C. . . . . 02(8)
Neither.,. . . . . 03(4)
Normal Pregnancy . . . 04fN.C.
Normal delivery. . . . 05(N.C.
Vasectomy. . . . . 06fN.C.

8. When did (PERSON) first notice the (CONDITION)?

Month / Date / Year (9)

More than a year ago . . . . 01 (NC)

Discovered by a doctor or other medical provider . . . 02 (A)

A. When was it discovered?

Month / Date / Year (10)

More than a year ago . . . . 01 (NC)

IF DOCTOR NEVER CONTACTED (Q. 3), SKIP TO Q. 10.

9. About how soon after (PERSON) first noticed the (CONDITION) did he actually get in touch with a doctor or other medical person about it--how many hours, days, or weeks?

[ ] hours [ ] days [ ] weeks

10. When (PERSON) first [noticed/learned about] the (CONDITION), how serious did he think it was--very serious, somewhat serious, or not serious at all?

Very serious . . . . . 01 (NC)

Somewhat serious . . . . . 02 (NC)

Not serious at all . . . . . 03 (NC)

Don't know . . . . . 94 (NC)

IF ACCIDENT OR INJURY, ASK Q's. 11 THROUGH 18.

11. When did the accident or injury happen?

Month / Date / Year

Over a year ago. 01 (14)

IF DOCTOR NEVER CONTACTED (Q. 3), SKIP TO Q. 13.

12. About how soon after the accident did (PERSON) actually get In touch with a doctor or other medical person--how many hours, days, or weeks

[ ] hours [ ] days [ ] weeks

13. At the time of the accident, how serious did (PERSON) think the injury was--very serious, somewhat serious, or not serious at all?

Very serious 01

Somewhat serious 02

Not serious at all 03

14. At the time of the accident, what part of the body was hurt? What kind of injury was it? Anything else?

Part(s) of body	Kind of injury

IF ACCIDENT HAPPENED MORE THAN 3 MONTHS AGO, ASK Q. 15.

15. What part of the body is affected nov? How is (PERSON'S PART OF THE BODY) affected? Is (PERSON) affected in any other way?

Part(s) of body	Present Effects

16. Where did the accident happen?

At home (inside house) 01
At home (adjacent premises). 02
Street and highway (includes roadways and public sidewalks). 03
Farm 04
Industrial place (includes premises) . . . 05
School (Includes premises) 06
Place of recreation and sports, except at school 07
Other (SPECIFY) _____ 08

IF 14 YEARS OF OVER, ASK Q. 17.

17. Was (PERSON) at work at a job or business vhen the accident happened

Yes. 01
No 02
While in Armed Services. 03
Under 14 at time of accident . 04

18. Was a car, truck. bus or other motor vehicle involved in the accident in any vay?

Yes. . . . . 01 (A)
No. . . . . 02 (N

A. Was more than one vehicle Involved?

Yes. . . . . 01 (B
No . . . . . 02 (B

B. Was (it/either one) moving at the time?

Yes. 01
No 02

LETTER LAST CONDITION IS COMPLETED, GO TO PAGE HI-74

Chapter 3

LABOR MARKET EFFECTS OF CHRONIC HEART AND LUNG DISEASE

INTRODUCTION

This chapter presents estimates of the effects of chronic heart and lung disease on labor force participation and on earnings conditional on participation, using the 1978 Social Security Survey of Disability and Work (U.S. Department of Health and Human Services, Social Security Administration, 1981). Results are presented by age of onset of disease for 5 respiratory diseases (allergies, asthma, chronic bronchitis, emphysema, other chronic lung disease) and 5 coronary diseases (arteriosclerosis, heart attack, hypertension, other chronic heart disease and stroke).

The estimated model consists of a labor force participation equation and an earnings equation. The probability of being in the labor force is a logistic function of variables that influence income received if one works and income received if one does not work. Included in these variables are dummy variables indicating the presence or absence of each of 25 chronic diseases, as well as dummies for each of the 10 respiratory/coronary diseases of interest, by age of onset. The earnings equation contains these same health dummies. Estimates of the effects of each disease on participation and on earnings allow us to compute the expected losses associated with each disease by age of onset.

THE MODEL

In modelling the effects of various diseases on earnings it is standard practice (Bartel and Taubman, 1979; Mitchell and Butler, 1986) to distinguish the effects of each disease on participation from its effects on earnings given that one participates. Debilitating diseases such as emphysema and stroke may force a person to drop out of the labor force because he is physically unable to work, or may reduce earnings to the point where they fall below the reservation wage. If a person continues

working he may curtail hours (if free to do so) or suffer a drop in pay because he changes jobs or because his productivity falls. This implies a drop in earnings, conditional on working.

The decision to participate, and earnings, conditional on participation, constitute a two-equation system. The individual participates if the decision function, I_t, is positive. Earnings, Y_t, are observed only if the individual participates.

$$I_t = Z_t\delta - e_t \qquad \text{Participation decision} \qquad (3\text{-}1)$$

Participate if $I_t \geq 0$,

$$Y_t = X_t\beta + u_t \qquad \text{Earnings in labor market} \qquad (3\text{-}2)$$

Y_t observed if $I_t \geq 0$

Y_t not observed if $I_t < 0$.

Equation (3-l) can be viewed as a reduced-form equation that results from comparing the utility received from income and leisure, conditional on working, with the utility received from income and leisure given that the individual does not work. If income and leisure in each state are replaced by their exogenous determinants, one obtains equation (3-1).[1]

Because earnings in (3-2) are observed only for working persons, estimation of (3-2) involves a classic selectivity problem: persons for whom earnings data are available are in the lover tail of the error distribution in equation (3-l). As long as the errors in equations (3-l) and (3-2) are correlated, applying least squares to (3-2) results-in inconsistent parameter estimates since $E(u_t | Z_t\delta \geq e_t) \neq 0$.

To obtain consistent estimates of this system we follow the two-stage approach outlined by Lee (1983) [see also Maddala (1983)]. We assume that

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1. This implies that all variables entering (3-2) should enter (3-l).

the error term in the participation equation has a logistic distribution $F(e_t) = 1/[1+\exp(-Z_t\delta)]$, and estimate a logit model of labor force participation. The error term e_t can be transformed to an error term e_t^* with a standard normal distribution,

$$e_t^* = J(e_t) = \Phi^{-1}(F(e_t)),$$

where Φ^{-1} is the inverse of the standard normal distribution function. Assuming that e_t^* and u_t are bivariate normally distributed with correlation coefficient ρ and $V(u_t) = \sigma^2$, expected earnings are a linear function of X plus a term ϕ/F that represents the density of e_t^* conditional on working,

$$E(X_t\beta+u_t \mid e_t \leq Z_t\delta) = X_t\beta + \sigma\rho\phi[J(Z_t\delta)]/F(Z_t\delta) + v_t. \qquad (3\text{-}3)$$

Applying OLS to (3-3) yields consistent estimates of the parameters β and $\rho\sigma$.[2]

THE DATA

The Sample

The data used to estimate our model come from the 1978 Social Security Survey of Disability and Work (U.S. Department of Health and Human Services, Social Security Administration, 1981). The survey, which was designed to examine issues relating to eligibility for disability benefits and the effects of disabilities on labor force participation, consists of two samples, a stratified random sample of 6,853 persons from the 1976 Health Interview Survey, and a sample of 4,886 persons from the population of recipients of Social Security Disability Insurance who were declared eligible for benefits no earlier than 5 years before the survey. Our

2. The two-stage estimation procedure, including asymptotic standard errors (Haddala, 1983), was programmed by the authors using the SAS matrix language.

sample consists of 2,218 men between the ages of 18 and 65 from the Health Interview Survey portion of the Social Security Survey.[3]

Earnings Equation

To avoid transitory fluctuations during the survey week, earnings are measured as wages and salaries received from all jobs during 1977. (All earnings are measured in 1977 dollars.) The independent variables entering the earnings equation, X_t, are listed in Table 1. Earnings are assumed to depend on education (measured by a series of dummy variables), experience (proxied by a series of age dummies), experience squared, marital status, family size, race, locational dummies and the health variables described below and in Table 2.

Labor Force Participation Equation

As with earnings, participation is defined based on behavior throughout the 1977 calendar year. An individual is considered to have been in the labor force if he worked 30 or more weeks during the 1977. Men who did not work at all during 1977 are classified as not participating in the labor force. Men working between one and 29 weeks were eliminated from the sample on the grounds that these persons were either students or changed labor force status.

Since the decision to participate in the labor force is made by comparing the utility of income and leisure when in the labor force with income and leisure when out of the labor force, the variables in Z_t should include all those entering the earnings equation, plus variables that would affect income conditional on not participating, and variables that would affect the utility of leisure time. The only such variables available in the survey that are not included in X_t are (1) whether the individual is aware of Social Security disability benefits and (2) whether

3. There are a total of 2,626 men between 18 and 65 in the HIS portion of the Social Security survey. 408 of them were eliminated because they appeared to change labor force status during 1977, the year for which participation and earnings were measured.

the individual is a veteran, both of which might affect income received if the individual did not participate. A third variable included in Z_t to capture motives for working is the size of the respondent's debt.

Health Variables

The survey contains two types of information about chronic illness. Respondents were asked whether they had ever been diagnosed by a doctor as having any one of the 35 chronic diseases listed in Table 2, as well as when the disease first began to bother them (age of onset). They were also asked whether they were functionally limited by any of the diseases. Functional limitation questions include whether the respondent had difficulty walking, climbing stairs, lifting heavy objects, etc. Respondents were also asked whether they experienced symptoms such as pain, fatigue, swelling and shortness of breath.

In both the earnings and participation equations the effects of chronic disease are measured by dummy variables that indicate the presence of a chronic condition. Measures of functional limitation, while possibly useful as indicators of the severity of disease, are not associated with specific diseases and, hence, cannot be used to measure the effects of individual diseases.[4]

In measuring the effect of particular diseases on participation and on earnings we would like to distinguish effects by age of onset and by duration of the disease. It is generally believed (Bartel and Taubman, 1979) that, other things equal, a man is more likely to participate in the labor force at any age the earlier in life he contracted a chronic disease.

4. In addition to collecting these measures of functional limitation, the survey also asks respondents if they "have a disability that limits the type or amount of work [they] can do?" This variable, which is included in addition to the chronic disease dummies in Mitchell and Butler's (1986) analysis of the labor market effects of arthritis, was excluded from our analysis for two reasons. First, the answer to this question is not an exogenous measure of health but reflects the decision to stop/continue working. Second, the variable captures some of the effects of specific diseases that we wish to capture using disease-specific dummies.

The argument is that the benefits of making adjustments to the disease (retraining, changing occupations) are larger the earlier in life the disease is contracted. Thus, the earlier the age of onset the more likely it is that adjustments will be made. It is not, however, clear that the human capital argument applies to the diseases examined here, most of which are contracted later in life (see Table 3). Since one seldom witnesses changes in occupation after age 45 it is unlikely that small variations in age of onset matter after this age. Indeed, age of onset may have a positive effect on participation if a disease is more serious when contracted at an earlier age.

It is also of interest to see how the duration of a disease alters labor market behavior. For two persons who contracted emphysema at age 45, are effects on earnings greater for a person currently 50 or for a person currently 60? Holding age of onset constant, this is equivalent to asking whether the disease has a greater effect on participation and earnings when one has had the disease for five years or for fifteen years. One might hypothesize that the longer one has had a disease the longer he has had to adjust to it; hence, labor market effects should diminish with duration. On the other hand, for progressive diseases, e.g., emphysema, the longer one has had the disease the more serious it is likely to be.

The extent to which we can distinguish labor market effects by duration of disease and by age of onset depends on the disease studied. In our sample few cases of emphysema, arteriosclerosis or stroke occur before age 45. [Table 3 gives the distribution of age of onset for persons in our sample for each of the 10 respiratory and circulatory diseases studied.] For this reason these diseases are represented by only two age of onset dummies indicating that the disease was contracted between the ages of 45 and 54 or between the ages of 55 and 65.

Chronic bronchitis and other chronic lung disease occur earlier in life than emphysema; however, the small numbers of persons in our sample with these conditions restrict us to only two age of onset categories for each disease: before age 45 and after age 45. Allergies, asthma, heart attack, hypertension, and other chronic heart disease occur frequently enough and

early enough in life that we can distinguish between 3 and 5 age of onset categories for each disease, as indicated in Table 2.

We have attempted to distinguish between duration of disease and age of onset only for those diseases that appeared to have a significant effect on labor force participation when age of onset alone was measured. These included emphysema, arteriosclerosis, heart attack, stroke and other heart disease. Each disease was significant only when age of onset was 45 or older. The fact that these diseases occur later in life, together with a maximum sample age of 65, means that we can distinguish only two duration categories: persons who have had the disease O-5 years and persons who have had the disease 5-10 years.[5]

RESULTS

Labor Force Participation

The more serious respiratory and circulatory diseases that we examine --chronic bronchitis and emphysema; arteriosclerosis, heart attack, stroke and other heart disease--significantly reduce the probability that a man participates in the labor force, other things equal. Table 4 presents coefficients obtained from the logistic participation equation for the respiratory and circulatory disease variables listed in Table 2. [The coefficients of other variables in the participation equation appear in the appendix to this chapter.] The table indicates that the less serious diseases--allergies, asthma, other chronic lung disease and hypertension--have no significant effects on participation. To calculate the effect of each disease on probability of participation its coefficient must be multiplied by P(l-P), where P is the probability of participation. Since P = 0.670 for our sample, the coefficients in Table 4 imply that contracting emphysema between ages 45 and 54 reduces the probability of participating in the labor force by an average of 23.3 percentage points.

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5. Chronic bronchitis beginning between ages 25 and 44 significantly decreased the probability of labor force participation; however, there were too few persons who had had chronic bronchitis for more than 10 years to permit using additional duration dummies for this disease.

Arteriosclerosis reduces probability of participation by 15.6 percent, while having a stroke between 45 and 54 reduces subsequent probability of participation by 57.3 percent.

What is somewhat surprising is the effect of age of onset on participation. For emphysema, arteriosclerosis, heart attack and stroke, an age of onset between 45 and 54 significantly reduces probability of working at all future ages, but an age of onset between 55 and 65 does not. Such a result runs counter to the standard argument that, the earlier the onset of a disability, the more likely it is that the individual will adjust to it by retraining and/or switching jobs. One reason that the standard argument may not apply is that, for the diseases studied here, a diagnosis at age 45 may indicate a more severe case of the disease than a diagnosis at age 60 (a heart attack at age 45 is often more devastating than a heart attack at age 60).

A second possibility is that for progressive diseases such as emphysema and arteriosclerosis, persons who contract the disease earlier will, on average, have had it for a longer time than persons who contract it later in life. To the extent that severity increases with the duration of the disease persons who have had the disease longer will be less likely to work.[6] The results in Table 4 may thus be due to the fact that age of onset is directly correlated with the number of years the individual has been bothered by the disease.

To test this hypothesis the age of onset categories in Table 2 were subdivided to distinguish duration of disease from age of onset. Persons with an age of onset between 45 and 54 were divided into two categories: those who had had the disease for O-5 years and those who had had the

6. One could, of course, argue that persons with very severe cases of the disease die soon after diagnosis: hence duration may not measure severity.

disease for 6-10 years. For persons with an age of onset between 55 and 65 only the O-5 year duration category was used.[7]

The estimated coefficients of the age of onset/duration dummy variables appear in Table 5. These coefficients suggest that controlling for duration alters the effect of age of onset only in the case of emphysema. For emphysema, when duration is held constant at O-5 years, age of onset has no effect on participation. Having the disease for 6-10 years, however, significantly reduces the probability of participation. In the case of arteriosclerosis, heart attack and stroke, however, the main effect on labor force participation is caused by age of onset, with onset between 45 and 54 making participation less likely, and onset between 55 and 65 having no significant effect. These results suggest that the effect of age of onset and duration are, in general, disease-specific.

Earnings

The results for our earnings equations suggest that, for the respiratory and coronary diseases studied here, most labor market effects occur through reductions in participation rather than reductions in earnings. Table 6 presents coefficients of the disease dummies in an earnings equation in which diseases are distinguished by age of onset and, in the case of emphysema, by duration.[8] The only respiratory and circulatory diseases studied that significantly reduce earnings are asthma, chronic bronchitis and heart attack. In each case earnings are reduced by about $2,000 ($1977). Emphysema and stroke have statistically significant but positive coefficients, indicating that persons with these diseases, given that they are working, earn more than persons without the conditions.[9]

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7. Persons with an age of onset between 55 and 65 with duration greater than 5 years thus had a value of zero for all health dummies, as did persons without the disease.

8. Because fewer chronically ill people appear in the earnings equation than in the participation equation it was necessary to eliminate certain age of onset categories from the earnings equations.

9. This result may be caused by our inability to control for the respondent's occupation and industry.

The Magnitude of Expected Earnings Losses

The expected loss in earnings to a person who contracts a chronic disease is the sum of the effects of the disease on probability of participation, and on earnings, given that one participates, Specifically, the expected loss in earnings is the sum of the change in probability of participation times pre-illness earnings, plus the reduction in earnings caused by the disease times the post-illness participation rate, P_1,

$$\text{Expected Loss in Earnings} = \Delta P(\text{Earnings}_0) + P_1(\Delta\text{Earnings}). \qquad (3\text{-}4)$$

This loss begins at age of onset and continues until the age that retirement would occur in the absence of the disease.

Tables 7 and 8 present estimates of the first term in (3-4), expected earnings losses due to non-participation. The effect of each disease on probability of participation, AP, is determined by multiplying the coefficient of the disease in the participation equation, δ_1, by P(l-P), where P is the probability of being in the labor force. Table 7 presents estimates of AP, the fraction by which pre-illness earnings are reduced due to non-participation. In the table, P is estimated at each age from Bureau of Labor Statistics data on labor force participation rates (U.S. Department of Labor, Bureau of Labor Statistics, 1988). In Table 8, ΔP has been multiplied by average 1987 earnings of all male workers to produce annual earnings losses, by age, due to non-participation.

In both tables earnings losses due to increased probability of not working peak between 55 and 65, because P(l-P) is maximized in this interval.. The maximum annual expected reduction in earnings ranges from 15.5% for heart attacks to 57.1% for strokes. Bronchitis and emphysema each reduce expected earnings (through effects on participation) by at most 25%.

For emphysema, arteriosclerosis, stroke and other heart disease earnings losses due to reduced probability of participation constitute the

total change in expected earnings. For chronic bronchitis, asthma and heart attack the second term in equation (3-4) must be computed. This term, in $1987, appears in Table 8 together with expected earnings losses due to non-participation.

Comparison with Previous Work

The only study of the labor market effects of chronic respiratory and circulatory diseases of which we are aware is Bartel and Taubman (1979). Using data from the NAS Twins Panel, Bartel and Taubman examine the effects of each of several disease groups on labor force participation and on earnings, conditional on participation. Unfortunately the diseases used in our study do not correspond exactly to the disease groupings used by Bartel and Taubman. They combine bronchitis, emphysema and asthma into a single disease category (BRON), and heart disease and hypertension into another category (HH). The effect of each disease category is examined for various ages of onset; however, emphasis is placed on diagnoses that occurred between 1962-67, when respondents were in their early forties. Because emphysema, arteriosclerosis and stroke are rare at this age, it is unlikely that BRON and HH capture these more severe diseases.

When they examine the effects of a diagnosis at age 40 on participation at age 50 Bartel and Taubman do not find any significant effects of respiratory or circulatory diseases on labor force participation.' This is in sharp contrast to the results presented in Table 7, which indicate that chronic bronchitis, emphysema, arteriosclerosis, heart attack, stroke, and other heart disease reduce the probability of labor force participation between 6 and 57 percentage points. The difference in findings may be due in part to the relatively young age of their sample. The disease variable used in the participation equation represents the effects on participation at (mean) age 50 of a diagnosis that occurred at (mean) age 40. For the diseases we study the most significant effects on participation correspond to an average age of onset of 50.

Bartel and Taubman, on the other hand, find a larger effect of respiratory diseases on earnings than we do. They find that a diagnosis of

respiratory illness (BRON) at age 40 reduces earnings by 29% at age 50. By contrast, we find that having chronic bronchitis reduces earnings by an average of 15% for persons who continue working. The corresponding reduction in earnings due to asthma is 13%. One must, however, be careful in comparing these results. Because we do not distinguish age of onset in estimating the effects of chronic bronchitis or asthma on earnings, our results correspond to an average age of onset of 32 for chronic bronchitis and 18 for asthma. Bartel and Taubman, by contrast, estimate the effect of contracting respiratory disease at age 40. It may well be the case that respiratory disease contracted at age 40 is more severe than chronic bronchitis or asthma contracted earlier in life.

Our findings are comparable to Bartel and Taubman's regarding the effects of heart disease. Bartel and Taubman find that heart disease/hypertension (AH), diagnosed at age 40, reduces earnings by 8.5% at age 50. For our sample, having a heart attack between 45 and 54 reduces subsequent earnings by about $2,000 ($1977) or 14.6 percent.

Table 1. Non-health Variables Entering Earnings and Participation Equations

	Mean	Standard deviation	Maximum	Minimum
Earnings, 1977	15,195.70			
In labor force, 1977	0.670		1	0
Married[a]	0.718	0.45	1	0
No. in household[a]	3.294	1.732	15	1
No. children < 5[a]	0.190	0.512	5	0
No. children 5-18[a]	0.670	1.174	8	0
No. children > 18[a]	0.184	0.482	3	0
Age dummies:				
18-24	0.141	0.348	1	0
35-44	0.174	0.379	1	0
45-54	0.222	0.416	1	0
55-65	0.261	0.440	1	0
Highest educ. level:				
Elementary school	0.193	0.394	1	0
High school	0.487	0.500	1	0
College	0.229	0.421	1	0
Non-white	0.124	0.330	1	0
Regional dummies[a]:				
Northcentral	0.265	0.441	1	0
South	0.335	0.472	1	0
West	0.178	0.383	1	0
Lives in Urban Area[a]	0.679	0.467		0
(Age-16)^2	888.25	730.23	240:	4
Veteran	0.452	0.498	1	0
Aware of disability benefits	0.407	0.491	1	0
Debt[a]	2116.9	8858.00	200800	0

[a]Measured as of interview date

Table 2. Health Variables in Earnings and Participation Equations

Each of the following variables assume a value of 1 if the respondent contracted the disease at the age indicated and a value of 0 otherwise:

RESPIRATORY AND CIRCULATORY DISBASES

	Age of Onset Categories (Sample Size)			
Allergies	o-17 (35)	18-34 (37)	35-65 (18)	
Asthma	o-17 (40)	18-34 (14)	35-65 (19)	
Chronic Bronchitis	25-44 (18)	45-65 (21)		
Emphysema	45-54 (49)	55-65 (23)		
Other Chronic Lung Dis.	18-44 (17)	45-65 (26)		
Arteriosclerosis	45-54 (55)	55-65 (24)		
Heart Attack	25-44 (28)	45-54 (57)	55-65 (42)	
Hypertension	25-34 (57)	35-44 (79)	45-54 (148)	55-65 (66)
Other Chronic Heart Disease	O-34 (23)	35-44 (34)	45-54 (51)	55-65 (22)
Stroke	45-54 (17)	55-65 (20)		

OTHER CHRONIC DISBASES	**Sample Size**
Arthritis or rheumatism	367
Other trouble with back or spine	296
Deformity of foot, leg, arm, hand	228
Nervous or emotional problems	209
Deformity of back or spine	154
Deafness	133
Stomach ulcer	130
Diabetes	113
Hernia or rupture	92
Difficulty reading (with glasses)	86
Kidney stones or kidney trouble	76
Other chronic stomach trouble	64
Tumor, cyst or growth	5 2
Missing arms, hands or fingers	46
Gallbladder or liver trouble	40
Paralysis	35
Alcohol or drug problems	25
Cancer	24
Epileptic seizures	24
Mental illness	20
Blindness	19
Thyroid trouble or goiter	18
Missing legs or feet	14
Tuberculosis	7
Multiple sclerosis	6

Table 3. Distribution of Respiratory and Circulatory Diseases by Age of Onset

	Number of persons in sample with age of onset					
	O-17	18-24	25-34	35-44	45-54	55-65
Allergies	35	18	19	10	4	4
Asthma	40	5	9	7	9	3
Chronic Bronchitis	15	2	13	5	15	6
Emphysema	0	1	4	3	49	23
Other Chronic Lung Diseases	1	4	7	6	20	6
Arteriosclerosis	0	0	7	11	55	24
Heart Attack	2	0	- 5	23	57	42
Hypertension	12	23	57	79	148	66
Other Chronic Heart Disease	18	5	10	34	51	22
Stroke	1	0	2	2	17	20

Table 4. Effects of Chronic Diseases on Labor Force Participation by Age of Onset

	Age of onset	Coefficient	|t-Ratio|
Asthma	o-17	**0.093**	0.22
	18-34	0.625	0.75
	35-65	0.093	0.16
Allergies	o-17	-0.061	0.13
	18-34	0.505	0.95
	3 5 - 6 5	-0.565	0.91
Chronic Bronchitis	25-44	-1.229	1.69
	45-65	-0.816	1.17
Emphysema	45-54	-1.053	2.55
	55-65	-0.683	1.21
Other Chronic Lung Disease	18-44	**-0.218**	0.29
	45-65	-0.528	0.95
Arteriosclerosis	45-54	-0.707	1.72
	55-65	0.134	0.26
Hypertension	25-34	-0.435	1.16
	35-44	-0.131	0.38
	45-54	0.189	0.78
	55-65	-0.112	0.34
Heart Attack	25-44	-0.463	0.94
	45-54	-0.720	1.94
	55-65	0.507	1.15
Stroke	45-54	-2.593	2.38
	55-65	-1.530	1.41
Other Heart Disease	o-34	-0.393	0.90
	35-44	-0.184	0.40
	45-54	-0.896	2.39
	55-65	-1.462	2.04

Table 5. Effects of Chronic Diseases on Labor Force Participation by Duration of Disease and Age of Onset

	Duration	Onset	Coefficient	t-Ratio
Asthma		o-17	0.017	0.04
		18-34	0.780	0.92
		35-65	0.029	0.05
Allergies		o-17	-0.040	0.09
		18-34	0.542	1.02
		35-65	-0.479	0.78
Chronic Bronchitis		25-44	-1.254	1.70
		45-65	-1.013	1.46
Emphysema	0-5	45-54	-0.230	0.35
	5-10	45-54	-1.299	2.04
	o-5	55-65	-0.370	0.62
Other Chronic Lung Diseases		18-44	-0.465	0.65
		45-65	-0.670	1.19
Arteriosclerosis	0-5	45-54	-0.389	0.57
	5-10	45-54	-0.252	0.41
	o-5	55-65	0.659	1.11
Hypertension		25-34	-0.418	1.12
		35-44	-0.151	0.44
		45-54	0.084	0.35
		55-65	-0.088	0.27
Heart Attack		25-44	-0.449	0.91
	0-5	45-54	-1.003	1.70
	5-10	45-54	-1.069	1.85
	o-5	55-65	0.371	0.79
Stroke	o-5	45-54	-1.503	1.25
	5-10	45-54	-7.551	0.38
	o-5	55-65	-0.900	1.06
Other Heart Disease		o-34	-0.352	0.81
		35-44	-0.165	0.36
	0-5	45-54	-1.119	1.75
	5-10	45-54	-0.007	0.01
	o-5	55-65	-1.273	1.73

Table 6Effects of Chronic Diseases on Earnings by Age of Onset

	Age of onset	Coefficient	| t-Ratio |
As t hma	-	-1964.2	1.66
Allergies	-	-543.51	0.542
Chronic Bronchitis	-	-2301.0	1.28
Emphysema	0-5[a]	3330.1	1.81
	6-10[a]	-1317.7	0.498
Other Chronic Lung Disease	-	281.05	0.138
Arteriosclerosis	45-54	1136.2	0.539
	55-65	-1333.2	0.623
Hypertension	25-34	1903.6	1.62
	35-44	420.97	0.369
	45-54	93.782	0.113
	55-65	677.55	0.491
Heart Attack	25-44	-1861.1	0.969
	45-54	-2217.9	1.25
	55-65	-1505.1	0.881
Stroke	-	6378.2	2.04
Other Heart Disease	35-44	1626.8	1.05
	45-54	-177.05	0.102

[a]Denotes duration of disease rather than age of onset.

Table 7. Effect of Respiratory and Circulatory Diseases on Probability of Participation by Age of Onset

		Change in probability of participation at each age				
Disease	Age of Onset	25-34	35-44	45-54	55-65	65+
Chronic Bronchitis	25	-0.067	-0.067	-0.111	-0.288	-0.180
	45			-0.084	-0.218	-0.136
Emphysema	45			-0.099	-0.256	-0.159
Arteriosclerosis	45			-0.060	-0.157	-0.098
Heart Attack	45			-0.059	-0.155	-0.096
Stroke	45			-0.220	-0.571	-0.356
	55				-0.327	-0.204
Other Heart Disease	45			-0.075	-0.196	-0.122
	55				-0.324	-0.202

Table 8. Annual Change in Expected Earnings at Each Age Due to Various Chronic Diseases ($1987)

Disease	Age of onset	Annual Change Due to Reduced Probability of Participation (Change Due to Reduction in Earnings if Working)				
		25-34	35-44	45-54	55-65	65+
Asthma		$0 (-3483.3)	$0 (-3483.3)	$0 (-3339.7)	$0 (-2489.1)	$0 (-600.2)
Chronic Bronchitis	25	-1487.6 (-4080.6)	-2096.3 (-4080.6)	-3810.4 (-3912.3)	-8309.3 (-2915.9)	-2872.5 (-703.1)
	45			-2888.2 (-3912.3)	-6298.2 (-2915.9)	-2177.3 (-703.1)
Emphysema	45			-3381.9	-7374.8	-2549.5
Arteriosclerosis	45			-2069.4	-4512.6	-1560.0
Heart Attack	45			-2047.4 (-3771.0)	-4464.6 (-2810.6)	-1543.4 (-677.7)
Stroke	45			-7548.4	-16460.7	-5690.5
	55				-9420.5	-3256.7
Other Heart Disease	45			-2587.6	-5642.8	-1950.7
	55				-9325.8	-3223.9

Table A.1 Coefficients of Non-Health Variables in Participation Equation

	Coefficient	|t-Ratio|
Married[a]	0.8989	5.89
No. in household	-0.1290	2.58
No. children < 5[a]	0.4072	2.56
No. children 5-18[a]	0.1060	1.34
No. children > 18[a]	0.3216	2.23
Age dummies:		
18-24	-1.2822	5.92
35-44	1.1440	4.28
45-54	1.5330	3.75
55-65	2.2198	3.55
Highest educ. level:		
Elementary school	-0.2006	0.84
High school	0.1312	0.65
College	0.0386	1.38
Nonwhite	-0.5886	3.39
Regional dummies[a]:		
Northcentral	0.3662	2.17
South	-0.1020	0.64
West	-0.0808	0.45
Lives in Urban Area[a]	0.1852	1.46
$(Age-16)^2$	-0.00160	4.54
Veteran	-0.1077	0.81
Aware of disability benefits	-1.0358	8.68
Debt[a]	0.00004	2.56

[a]Measured as of interview date

Table A.2 Coefficients of Remaining Health Variables in Participation Equation

Disease	Coefficient	|t-Ratio|
Arthritis or rheumatism	-0.2791	1.65
Other trouble with back or spine	-0.4597	2.79
Deformity of foot, leg, arm, hand	-0.3741	1.89
Nervous or emotional problems	-0.8574	4.10
Deformity of back or spine	-0.7925	3.53
Deafness	-0.2624	1.08
Stomach ulcer	-0.2714	1.11
Diabetes	-0.1334	0.49
Hernia or rupture	0.005837	0.02
Difficulty reading (with glasses)	-0.2017	0.65
Kidney stones or kidney trouble	-0.1528	0.48
Other chronic stomach trouble	-0.2896	0.85
Tumor, cyst or growth	0.1030	0.27
Missing arms, hands or fingers	-0.5395	1.42
Gallbladder or liver trouble	-1.1440	2.40
Paralysis	-1.9011	3.49
Alcohol or drug problems	-1.4264	2.46
Cancer	-0.82301	1.56
Epileptic seizures	-1.5235	2.18
Mental illness	-1.0498	1.60
Blindness	0.1043	0.16
Thyroid trouble or goiter	-0.2380	0.39
Missing legs or feet	-0.5794	0.84
Tuberculosis	0.1099	0.09
Multiple sclerosis	-2.3758	1.78

Table A.3 Coefficients of Non-Health Variables in Earnings Equation

	Coefficient	t-Ratio
Married'	1504.1	2.64
No. in household	-208.5	0.98
No. children < 5[a]	333.89	0.82
No. children 5-18'	109.5	0.41
No. children > 18[a]	979.0	2.16
Age dummies:		
18-24	-3172.0	4.02
35-44	2171.2	2.89
'45-54	1917.8	1.50
55-65	415.1	0.22
Highest educ. level:		
Elementary school	-3183.2	4.09
High school	-1192.7	1.88
College	2505.0	3.71
Nonwhite	-2283.9	3.49
Regional dummies':		
Northcentral	1428.2	2.81
South	234.0	0.46
West	1626.5	2.86
Lives in Urban Area'	1176.7	2.94
$(Age-16)^2$	1.1	0.90

'Measured as of interview date

Table A.4 Coefficients of Remaining Health Variables in Earnings Equation

Disease	Coefficient	|t-Ratio|
Arthritis or rheumatism	-1472 .O	2.33
Other trouble with **back** or spine	-700.7	1.22
Deformity of foot, leg, arm, hand	-46i.6	0.62
Nervous or emotional problems	-883.9	0.88
Deformity of back or spine	-1430.3	1.49
Deafness	-640.3	0.69
Stomach ulcer	-1879.3	2.07
Diabetes	-1915.6	'2.08
Hernia or rupture	-932.1	0.88
Difficulty reading (with glasses)	55.5	0.04
Kidney stones or kidney trouble	-337.6	0.27
Other chronic stomach trouble	1141.5	0.87
Tumor , cyst or growth	-1539.3	1.24
Missing arms, hands or fingers	2756.9	2.01
Gallbladder or liver trouble	1709.5	0.69
Paralysis	-5386.6	1.63
Alcohol or drug problems	3156.0	1.02
C a n c e r	-2823.1	1.21
Epileptic seizures	-3054.4	0.89
Mental illness	-879.1	0.26
Blindness	-2651.4	1.15
Thyroid trouble or goiter	-1030.4	0.45
Missing legs or feet	1026.9	0.33
Tuberculosis	1653.6	0.42
Multiple sclerosis	10466.6	1.58

Chapter 4

SURVEY COMPONENT

The survey component of this project has been the most difficult to design and implement. This chapter provides a discussion of the original plans, the actions undertaken to implement those plans, and the subsequent modifications to those plans. Survey related materials developed as part of this component are included as exhibits. Also enclosed are copies of written transcripts and video tapes of the two focus group sessions conducted to develop a suitable questionnaire.

ORIGINAL PLAN

This component of the project originally involved the conduct of a contingent valuation survey of people with chronic bronchitis or emphysema. This survey was designed to determine the effect of chronic lung disease on various aspects of the patient's life. We were then to develop a scenario to elicit from each participant what he would have paid, prior to contracting his disease, to reduce the probability of getting it. We felt that this complex hypothetical question was necessary because only people who already had the disease could truly appreciate the characteristics of the good they were being asked to value.

Our CV scenario was originally designed to create a plausible hypothetical situation in which persons who have COPD imagine themselves at the point before they were aware they had the disease. We planned to determine their approximate family income at that time, as well as their then-current work status, and their financial obligations (e.g., loans, children, other dependents). The WTP elicitation would then determine what they would have paid to reduce their probability of contracting COPD by a specified amount. At the time we realized that this would be a difficult undertaking, for each participant had both to understand simple probability concepts and to be able to imagine himself in his pre-illness state. Nevertheless, we felt it would be easier to make this scenario plausible

than to-get nonsufferers to imagine the experience of suffering from the illness they are being asked to value.

Because of the cost of conducting this type of research, the plan called for a study of 200 persons with these diseases in clinics in the Baltimore and Washington SMSAs. The CV study was to be preceded by focus groups and by in-depth pretesting of the CV instrument. The focus groups were to be conducted with patients from the Francis Scott Key Clinic in Baltimore.

IMPLEMENTING THE PLAN

After sketching out a preliminary questionnaire, we organized two focus groups, each intended to have eight people (however, only six persons and five persons showed up for the first and second groups, respectively). The objective of this effort was (1) to elicit information and reaction from the focus group members to our WTP questions and (2) to examine the consequences of their conditions for their lives. Both objectives were met.

Nevertheless, responses during the first focus group session and subsequent discussions among the project team led to a growing concern that the ex ante question would be unanswerable. This concern, coupled with the discovery of a paper by Viscusi and Evans (1988), led to the development of an additional WTP question involving the probability of a cure. With some modification, the Evans and Viscusi approach permitted the extrapolation of responses to this question to estimate the WTP for a reduced probability of getting the disease. The extrapolation procedure involves estimating utility functions for income, conditional on having and not having COPD, and then using these functions to estimate WTP for a change in the probability of having COPD.

We began the second focus group hoping to explore both the complicated ex ante WTP question and the probability of a cure question. Exhibit A is the protocol we developed to explore the latter question during the second focus group.

FIRST MODIFICATIONS TO THE PLAN

The second focus group provided us with a number of insights.

1) Most of the group considered credible and was able to answer the question about the WTP for a probability of a cure. It was, however, difficult to get persons to value small probabilities of a cure. Some persons, for example, felt that a probability of 10 percent was too small to be worth a bid. It was, furthermore, unclear whether persons made distinctions among probabilities of different magnitude.

2) Use of a drug for a cure was credible but pains had to be taken to convince respondents that there were no side effects.

3) No one considered changes in their life expectancy in their WTP answers even though we had evoked this effect before the question was asked. Afterwards, however, some felt this was an important consequence of being cured.

4) Nevertheless, it became clear that some people are quite fatalistic about their disease and are pessimistic about the quality of life of healthy, older people. They feel that increasing life expectancy or even improving quality of life may not be worth much because the life of an older person, even one without disease, is not very satisfying. This insight is important because it calls into question the validity of extrapolating responses of older people to those of younger people.

5) The WTP question as originally posed (attempting to take the person back before he had the disease) was judged to be too difficult to answer and to lack credibility.

6) A WTP question that took people back to just after they got the disease was judged to be easier to answer and to be more credible.

7) All of the focus group members thought that the idea of their paying to prevent their child from getting the disease (either with certainty or

with some probability) was credible and compelling. This idea arose out of discussion. It captures an important component of the total. social benefits of reducing COPD: WTP by loved ones to reduce the risk of the disease to persons in the target population.

Based on these insights, we decided to **ask** four WTP questions in the pretest:

I. WTP for possibility of a cure now

II. WTP for possibility of a cure when you first realized you had the disease, assuming you knew then what you know now

III. (For those with a child) WTP for a reduced risk of your disease appearing in your child.

IV. WTP for reduced risk of getting the disease as a multiple of bid in III, above.

Activities Related to the Modified Plan

We next developed the full survey instrument in accordance with the above modifications to our survey plan (Exhibit B) and made contacts for conducting the pretest (see exhibits C and D).[1] The survey was then administered by the principal investigators in the homes of two individuals living in the Washington SHSA and two individuals living in the Baltimore SMSA. .

1 A discussion of the logistics and sample identification and selection procedures is provided below.

Second Modification of the Plan

The pretests did not go well. The primary difficulty encountered was an apparent inability of the pretest participants to answer any of the willingness-to-pay questions. The participants seemed to understand the questions and probabilistic concepts and gave them a good faith effort, but appeared to lack an anchor for providing dollar values. Low income (being unable to afford to pay anything) was also a problem.

In retrospect, we may have been misled by the results of the focus group, particularly those from the second group. Some members of this group had participated in both sessions and were quite familiar with our objectives and perspective. What is more, they developed a bonding and support system that may have encouraged more thoughtful responses. In any case, 'when administering the questions in a person's home, and with little background or rapport established (beyond a letter and a phone call), the pretest participants did not behave as we thought they would.

Because of the negative results of the pretests we recommended use of the risk-risk trade-off approach (Magat, Viscusi, and Huber (MVH), 1988) administered to healthy relatives of individuals with chronic illness rather than to a sample of individuals drawn from the general population. In the MVH survey, individuals drawn from the general population were read a short description of a case history of chronic bronchitis and showed several pictures, among them the equipment used by patients with a serious case of bronchitis to aid in breathing. The justification for interviewing relatives (principally healthy children) is that this group is likely to have a far better understanding of the consequences of chronic disease for one's daily life than are persons in the general population, after hearing a description of the disease at the time of the interview.

We intend not only to use the MVH approach but to duplicate the protocol (insofar as possible) by using their diskette in a laptop computer taken into the homes of the relatives. Then, by comparing our results with those of MVH we will be able to test the hypothesis that this difference in

quantity and quality of information held by respondents affects their risk-risk trade-offs.

To make this test credible, information in addition to that elicited by the computer-assisted survey must be collected from the relatives. This includes information on their relationship to the person with chronic disease (including frequency of interaction) and information on the perceptions they hold about the severity of the relative's disease. Because the respondents may tend to displace the description of the case of chronic bronchitis read to them (the same one used by HVH) with their perceptions of their relative's disease (rather than respond more sensitively and thoughtfully to the case description read to them), we plan to ask respondents for their risk-risk trade-offs to both a condition equivalent to their relative's and the case of chronic bronchitis used by MVH. This approach should help us to test and adjust for any displacement effect.

To carry out this approach requires measures of disease severity. To this end we are currently consulting the large literature on quality of life indexes and sickness profiles for a series of questions that characterize levels of severity. We also plan to administer a short questionnaire that includes these severity questions to our sample of people with chronic disease. Comparing the "true" severity of a condition (obtained from those with the condition) to the severity perceived by relatives will enable us to test whether the relatives do indeed have an accurate understanding of the disease. If they do not, then the maintained hypothesis about the effect of information on WTP cannot be tested and one cannot use the results to measure social costs of chronic disease. Rather, we can test only the influence of perceived severity on risk-risk trade-offs.

Sample Selection

A two-tier sampling strategy is needed for this component. The first tier involves obtaining a sample of people with chronic respiratory disease. The second tier involves using this sample to contact healthy

relatives (children, if possible) living in the area. The former group can be sampled by telephone, as only a short, relatively uncomplicated questionnaire is needed to elicit information about disease severity and personal characteristics. The relatives will be visited in their homes.

To obtain a sample of individuals with chronic respiratory disease we are following two parallel strategies. First, the out-patient list at Francis Scott Key Hospital in Baltimore was used to identify people with either emphysema or chronic bronchitis (or both). Approximately 80 people have been identified as potential participants from this list. Of these, we sent out letters to twenty people (Exhibit C) asking for their participation in the survey (this was for the original in-home survey of people with chronic disease, not for the planned telephone survey). We received twelve acceptances and two rejections.

At the same time, we obtained an agreement form the American Lung Association of Maryland to use their mailing list to identify a large number of Marylanders with chronic respiratory disease. This agreement is important for several reasons. First, it will expand the pool of potential survey participants. There is evidently a high proportion of chronic respiratory patients at Key Hospital who do not have our target diseases. Second, it will expand the socio-economic coverage of our sample. The patients at Key Hospital tend to be lower middle class, white, and blue collar.

The first ALA test mailing involved sending letters to twenty individuals on the ALA list living in Montgomery and Prince George's Counties (Exhibit D). The response rate here was very poor. Only two people agreed to participate. Many did not return the questionnaire (or the address was wrong), several did not have our target diseases, several refused outright, and some did not feel sick any longer and considered themselves in perfect health. Two had died. Because of the poor response rate, we are in the process of developing a better letter. Also, we are hopeful that the reduced time commitment and invasiveness of a telephone survey relative to an in-home survey will substantially increase the response rate.

A new letter has now been written to obtain participation of individuals with chronic respiratory disease contingent on their willingness and ability to provide us with addresses of healthy relatives living in the Washington-Baltimore area (Exhibit E).

Survey Logistics

Both of the new survey instruments (i.e., the phone survey for chronics and the in-home survey for their relatives) will be pretested first. Then, assuming the pretests are successful, the Survey Research Center of the University of Maryland will conduct the phone and face-to-face surveys. They will recruit graduate students for the telephone interviews and conduct as many in-home interviews with relatives as possible during Spring Break. Several laptop computers will be rented for the latter interviews and a license fee will be paid to Sawtooth Software, Inc. for use of their interactive programming routine.

THE MVH PROTOCOL

Before the second modification to our research plan, we were asked to evaluate the MVH approach. This was done in two stages: after reading the interim report and after taking the survey.

Overall, we feel that the approach is a significant improvement over other options for valuing nonmarketed public goods, although, at least insofar as one is considering the risk-risk trade-offs, it is tied to the attempts by others to value mortality (or other nonmorbidity) risks. It avoids the problem of starting point bias, is engaging, and, by revealing preferences through pairwise comparisons, appears to be an effective didactic as well as analytical strategy. The idea of posing the questions for risk increases and risk decreases is a good one because responses to these two questions do not have to be identical. It is useful to elicit the trade-off between cost-of-living (COL) and auto deaths to compute a value-of-life (VOL) that can be compared with those from the VOL literature.

Our criticisms of the approach focus on specifics, both in the description of the good being traded and the approach itself.

1) We take issue with some of the descriptions on the computer screens 11-15 and 24: Screen 11 implies that there are no premature mortality effects associated with chronic bronchitis. This is not correct to the best of our knowledge. Screen 14 implies that people with chronic bronchitis continue working. This is be no means generally true. Not mentioned are the often severe side effects from drugs and the inability to do work around the house. We question whether this comes close to describing what it is like to have this disease. In general, the problem with this approach is that the characteristics of the good being valued (chronic bronchitis) are dependent on the descriptions of the good provided by the researchers and the interpretation of this good by the respondent. The perceived disease description arising from this two-part process may be quite far from what is really wanted -- a description of the "average case of bronchitis". For instance, MVH describe a severe case but they assume no premature mortality. This approach can be criticized because it focuses on the more severe cases but also **because** severe bronchitis without premature mortality risk may be a rare occurrence in the population.

2) The notion of converting pure morbidity risk into mortality risk equivalents seems like a very difficult cognitive task and one that might be performed with great variance by the **same** person upon repeated trials.

3) The CB-auto death model works well when only these two states and a good health state are included. Once another health outcome (such as cancer) is included, the neat results of equation (5) break down (and information on the trade-off between this other outcome and CB must be known), even with separability in the utility function assumed. This problem could be addressed in the text by changing the definition of H from good health to **"all** other health states." The COL and storm damage models assume additive and separable utility in money and health and that utility is linear in money. Respondents are assumed to be risk-neutral in order to use the expected value of storm damage loss as a valuation measure.

4) Income constraints are not evoked for the risk-$ components.

5) The procedure for obtaining WTP for a l/100,000 risk reduction appears to involve dividing the bid by the relevant probability differences. For this to be a correct procedure requires making the strong assumption that bids are linear in probabilities. Mitchell finds that bids are not linear in probabilities.

6) Throughout the report, risk of auto death is referred to as risk of auto accident. The former is being traded off not the latter.

7) The COL-auto death trade-off questions were designed to validate the methodology. Given the results, we conclude that the methodology has a long way to go. As MVH show, one-third of the respondents gave inconsistent responses. This seems high. Interestingly, and unremarked by MVH, the component with bids that were most out of line (the COL-auto death component) has the highest consistency rate.

8) It is surprising to me that the INCOME variable was inconsequential to explaining responses to the COL questions. Absence of significance of this and other variables is disturbing for the components that do not involve risk-risk trade-offs.

Referring specifically to the diskette:

9) The questions asking for degree of importance to avoid various consequences of CB require moving a cursor. Slow movement of cursor may bias responses to starting position.

10) In general, slowness of cursor in degree of preference questions in trade-off section may encourage indifference response too early.

11) Health status question compares respondent's health to "friends your age" without asking for health status of these friends.

12) Respondents are asked if they know people with various chronic diseases but not if they are familiar with the person's symptoms and lifestyle.

13) Question on the degree to which a person is a passenger of a driver of a car is very good. In one case, risk is voluntarily assumed; in the other risk is largely involuntary.

14) The use of probabilities of x/100,000 has advantages and disadvantages. The major advantage is that it permits x to be relatively large and, hopefully, more comprehensible. On the other hand, 100,000 is an unfamiliar unit to most people.

15) There is a curious and potentially disruptive reference to the risk to "your immediate family" when the scenario is being described. Then, all subsequent questions refer to "your risk." Whose health and whose risk of death is being traded off?

16) The scenario involving choice between two areas is not motivated by any discussion, other than by noting that both areas are preferred to one's current area of residence. Perhaps it is self-evident or it is not important to provide more explicit motivation. But, we wonder.

17) During the trade-off test, repeated wrong answers do not invoke additional information. If learning takes place, it does so entirely within the respondent's mind. Respondents may not learn this way but may simply a) give up or b) change their answer to the

acceptable answer (there are only two choices) to get on with the questionnaire.

18) The numerical description of probabilities in the actual test is difficult to comprehend. The nature of the trade-off could be understood better with visual aids.

19) The response to the first trade-off question really keys the response. to the following questions. Is this desirable? Randomizing the order in which the sets of questions are presented would permit a test for independence.

20) It is possible that the responses would be very different if the baseline risks in each city were different (holding their relative risks constant) or if the step changes on subsequent panels were larger or smaller. Were these sensitivities tested for? More important, by the values of the key parameters (100,000th steps, the 75, 55 gap, and $80), the minimum and maximum WTP are predetermined: $80/20/100,000=$400,000 minimum and the maximum is $80/1/100,000=$8 million. If the units were in 10,000ths the responses would be the same, yet the VOL would now be between $40,000 and $800,000. The program should be changed so that the step size gets smaller (say one in a million) when the 1/100000th trade-off point is reached. [Evidently, Version C incorporates this change.]

21) Were interviewers poised to intervene when the respondent had difficulty? Or when they were asked questions? If they were, is there a record of what they said? What were they instructed to say? Did extensive pretesting get the questionnaire in shape enough to avoid interviewer input?

22) What is the purpose of the life insurance question?

We gave the questionnaire to two secretaries at RFF in addition to taking it ourselves. Notes on their reactions are included as Exhibit F.

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Exhibit A

Sample Focus Group Questions

WE WANT TO DEVELOP A QUESTION FOR PEOPLE WITH COPD THAT ELICITS THEIR WTP FOR A POSSIBILITY OF A CURE.

1) IS THE IDEA OF A CURE SOMETHING THAT YOU CAN IMAGINE?

2) HOW COULD THIS CURE BE PLAUSIBLY ADMINISTERED? BY A DRUG, AN OPERATION, NO NEED TO BE SPECIFIC?

3) THIS CURE WOULD BE PAINLESS, INSTANTANEOUS AND IRREVERSIBLE? CAN YOU ACCEPT THIS?

4) HOW CAN THE MEANING OF A CURE BE CONVEYED? THAT IS, WHAT WOULD NORMAL LIFE MEAN TO YOU? DO YOU THINK ABOUT DIFFERENCES IN LIFE EXPECTANCY (SHOW TABLE AND PROBE PERCENTAGE REDUCTION IN LIFE EXPECTANCY, NUMBER OF YEARS LEFT, AND AGE OF DEATH FORM OF QUESTION), INCOME DIFFERENCES, IF NOT RETIRED, CHANGES IN DAY-TO-DAY LIVING?

5) HOW CAN THE CONCEPT OF PROBABILITY BEST BE CONVEYED? WE COULD PROVIDE A VERBAL EXPLANATION (E.G., ONE OUT OF EVERY TEN PERSONS TAKING THE CURE WILL BE CURED, NINE WILL NOT), PROBE TO SEE IF THEY UNDERSTAND THIS, AND HOW THEY INTERPRET IT, FOLLOW THIS BY A VISUAL AID, E.G., A "WHEEL OF CHANCE," AND PROBE TO SEE IF THEY UNDERSTAND THE CONCEPT ANY BETTER.

6) DOES THE FACT THAT YOU WOULD HAVE TO PAY FOR THIS CHANCE OF A CURE BOTHER YOU, PARTICULARLY GIVEN THAT YOU HAVE TO PAY WHETHER YOU ARE CURED OR NOT?

7) HOW COULD THE PAYMENT BE MADE PLAUSIBLE? THAT IS, SHOULD WE TALK ABOUT A LUMP SUM, AN OPTION OF FINANCING PAYMENT? DOES IT MATTER WHO RECEIVES THE PAYMENT (E.G. A GOVERNMENT AGENCY, THE HEALTH CARE PROVIDER?)

8) WHEN YOU THINK ABOUT PAYING FOR THE CURE DO YOU THINK ABOUT THE FACT THAT YOU. WOULD BE GIVING UP OTHER CONSUMPTION? HOW CAN WE EVOKE THIS IDEA?

9) CAN YOU GIVE US A WTP NOW? AS A PERCENT OF INCOME, AS AN ABSOLUTE AMOUNT, AS A PAYMENT PER MONTH? WHICH IS EASIER?

10) SUPPOSE THERE WAS A SMALL CHANCE OF DEATH FROM TRYING THIS CURE. IS THIS PLAUSIBLE TO YOU? HOW WOULD YOUR ANSWER BE DIFFERENT AND WHY?

ROBERT: IF THERE'S TIME YOU COULD TRY TO PROBE FOR AN OBJECTIVE BUT FAMILIAR MEASURE OF SEVERITY, SUCH AS THE NUMBER OF MINUTES YOU COULD WALK **ON** LEVEL GROUND WITHOUT REST.

Exhibit B

Introductory

1. How many years have you lived at your current address?

_____ years

2. What is your current marital status?

1 Married 2 Divorced 3 Single (never married)
4 other (describe)

a. If married,
Is your spouse living? Yes No.

1. If living,
Does your spouse reside with you? Yes No

b. If **2.a is YES,**
Please rate your spouse's health relative to the average person of his/her age and sex.

Excellent / good / average / below average / poor

3. How many children do you have now?

_____ children

5. What are their ages and sexes (M/F)?

Child 1: _____; Child 2: _____;
Child 3: _____; Child 4: _____;
Additional children:

6. Please rate their health relative to the average person their age and sex.

Excellent / good / average / below average / poor ?

Child 1: _____
Child 2: _____
Child 3: _____
Child 4: _____
Additional children: _____

7. Which children (if any) currently smoke cigarettes?

(Indicate child number from above) Children _____

Diagnosis

I'm going to ask you about some conditions or illnesses. The first is ASTHMA.

8. Have you ever been diagnosed by a doctor as having asthma?

1 Yes 2 No 3 Unsure, don' t know

a. IF YES

When was this? About 19___

b. When did the asthma first begin to bother you?

About 19___

c. Do you still suffer from it?

1 Yes 2 **No** 3 Unsure, don't know

d. When was the last time you were in the hospital overnight for this condition?

Year: _____ Month: _____ Never' _____

1. How many nights was that?

_____ nights

2. How many times have you been in the hospital overnight for this condition since the beginning of **1988?**

_____ times in 1988

e. Excluding when you were an overnight patient in a hospital, when was the last time you saw a doctor for this condition?

Year: _____ Month: _____ Never _____

f. How many times since the beginning of this year have you seen the doctor for this condition?

_____ times in 1988

****** ****** ******

How about CHRONIC BRONCHITIS?

9. Have you ever been diagnosed by a doctor as having this condition?

1 Yes 2 No 3 Unsure, don't know

a. IF YES

When was this? About 19___

b. When did this condition first begin to bother you?

About 19___

c. Do you still suffer from it?

1 Yes 2 No 3 Unsure, don't know

d. When **was** the last time you were in the hospital overnight for this condition?

Year: _____ Month: _____ Never _____

1. How many nights **was that?**

_____ nights

2. How many times have you been in the hospital overnight for this condition since the beginning of 19881

_____ times in 1988

e. Excluding when you were an overnight patient in **a** hospital, when was the last time you saw a doctor for this condition?

Year: _____ Month: _____ N e v e r

f. How many times since the beginning of 1988 have you seen the doctor for this condition?

_____ times in 1988

****** ****** ******

How About EMPHYSEMA?

10. Have you **ever** been diagnosed by a doctor as having this condition?

1 Yes 2 No 3 Unsure, don' t know

a. IF YES

When was this? About 19___

b. When did this condition first begin to bother you?

About 19___

c. Do you still suffer from it?

1 Yes 2 No 3 Unsure, don' t know

d. When was the last time you were in the hospital overnight for this condition?

Year: _____ Month: _____ Never_____

i. How many nights was that?

_____ nights

2. How many times have you been in the hospital overnight for this condition since the beginning of 1988?

_____ times in 1988

e. Excluding when you were an overnight patient in a hospital, when was the last time you saw a doctor for this condition?

Year: _____ Month: _____ Never_____

f. How many times since the beginning of 1988 have you seen the doctor for this condition?

_____ times in 1988

****** ****** ******

How about OTHER. LUNG diseases.

11. Have you ever been diagnosed by a doctor as having other lung diseases?

1 Yes 2 No 3 Unsure, don't know

a. IF YES

Which diseases was this? _____

b. Which of these other lung diseases is the most bothersome to you?

c. When was this most bothersome disease first diagnosed?

About 19___

d. When did this most bothersome disease first begin to bother you?

About 19___

e. Do you still suffer from it?

1 Yes 2 **No** 3 Unsure, don' t know

f. When was the last time you were in the hospital overnight for this condition?

Year: _____ Month: _____ Never_____

1. How many nights was that?

_____ nights

2. How many times have you been in the hospital overnight for this condition since the beginning of **1988?**

_____ times in 1988

g. Excluding when you were an overnight patient in a hospital, when was the last time you saw a doctor for this condition?

Year: _____ Month: _____ Never_____

h. How many times since the beginning of 1988 have you seen the doctor for this condition?

_____ times in 1988

****** ****** ******

12. Are there any other CHRONIC DISEASES you have ever been diagnosed by a doctor as having?

1 Yes 2 No 3 Unsure, don' t know

a. IF YES

Which diseases was this? (list)

b. Which of the diseases on this list is the most bothersome?

c. When was it first diagnosed?

About 19___

d. When did it first begin to bother you?

About 19___

e. Do you still suffer from it?

1 Yes 2 No 3 Unsure, don' t know

f. When was the last time you were in the hospital overnight for this condition?

Year:_____ Month:_____ Never_____

1. How many nights was that?

_____ nights

2. How many times have you been in the hospital overnight for this condition since the beginning of 19881

_____ times in 1988

g. Excluding when you were an overnight patient in a hospital, when was the last time you saw a doctor for this condition?

Year:_____ Month:_____ Never_____

h. How many times since the beginning of 1988 have you seen the doctor for this condition?

_____ times in 1988

******** ********** **********

Health Consequences

13.a. Considering the diseases you have and the health state of the average person of your age and sex, please rate your health:

excellent / good / average / below average / poor

13.b. Of the conditions you mentioned above, which is the most bothersome respiratory condition?

_____

Considering only this condition, since the first of the **year,**

13.b.l; How much do you estimate you have spent out of pocket for medical costs, including drugs, doctor visits, oxygen, hospital visits (i.e., the portion uncovered by insurance)?

Drugs: Name _____ Dosage _____ $_____/month

Name _____ Dosage _____ $_____/month

Name _____ Dosage _____ 4_____/month

Name _____ Dosage _____ $_____/month

Name _____ Dosage _____ $_____/month

Doctor Visits: _____/year $_____/year

Supplies: Type_____ $_____/year

Hospital Visits: _____nights/year $_____/year

Other: Type_____ $_____/year

13.B.2. What side effects, if any, did you have from the drugs?

Drug : _____ Side effect: _____
Drug : _____ Side effect: _____
Drug: _____ Side effect: _____

13.b.3. How much have you spent on non-medical items to help reduce your symptoms, e.g., air purifiers, mattress covers?

•
_____

13.c. How many hours did you spend in bed last week because of your condition?

_____hours

13.d. Whether you work inside or outside the home, how many hours last week did your condition cause you to lose work (counting BDH)?

_____hours

13.e. Not counting work or bed disability time, how many hours last week did your condition cause you 'to cut down on your normal activities?

_____hours

13.f. Was the severity of'your condition last week typical of the severity during 19881

about average worse than average better than average

13.g Here's a card showing the various effects of lung disease. Please rank them according to how much you worry about them (from 1 for the most worry).

Medical Costs___	Pain and Suffering____
Early death ___	Early retirement ____
Work related ___	Leisure related ____

Scenarios

I'd like to ask you a series of questions about a hypothetical situation involving your lung disease, but first I'd like to discuss the idea of taking chances. Specifically, I want you to think about gambles.

14. For instance, many states have a lottery where you can buy a ticket for a small amount of money, say $1.00, that gives you a very small chance (say one in ten million) of winning a lot of money, say $1 million.

a. Do you ever buy lottery tickets?

Yes No

b. If no, would you be willing to pay $1.00 for a l-in-2-million chance of winning $1 million?

Yes No

Why did you answer (yes/no)?

The type of gamble we just talked about is one where you pay a small amount of money for the (small) chance of winning big. Now, we

wish to ask you some hypothetical questions about this type of gamble, but referring to a cure for your disease rather than winning the lottery. Specifically, imagine that scientists came up with an experimental drug that could cure some people with your lung disease and the cure would be permanent.

By cure I mean that you would be freed of all your symptoms and the medical costs associated with lung disease. Your choices about work and leisure activities and the day-to-day quality of your life would be the same as others of your age and sex who do not have lung disease. Your life-expectency would also be the same as others of your age and sex.

The drug would be administered in a series of shots by your doctor over a period of several weeks. Unlike many drugs you are familiar with, this hypothetical drug would have absolutely no side effects. Within a month after the last shot you would either be permanently cured or your condition would continue just as it is now with no improvement from the drug.

Because the drug is experimental, neither the government nor the insurance companies will cover the cost of this drug to you. For at least the next ten years it will be available only to people who are willing to pay for the drug. I'd like to know how much you would be willing to pay for this treatment for yourself if your chances of a cure were one percent or one in a thousand. That is, of every 1000 people like you who took the drug, only one person would be cured. Unfortunately there is no way of knoving who that person will be until after the drug treatment is finished. This is a one-shot offer. If you turn it down once you cannot obtain the drug.

Here's a picture to convey the idea of a one in a thousand chance. There are a thousand squares here, each representing a person with your disease. The one square represents the person that the drug works for.

Here's a card [A] that summarizes this situation. Please look at it and tell me if you have any questions.

[GO OVER CARD WITH RESPONDENT POINTING OUT ITS FEATURES AND RECORDING ALL QUESTIONS AND COMMENTS MADE BY THE RESPONDENT. THEN SAY:] Note that if you die before the payments are complete they will become the responsibility of your heirs.. Also note how this choice is like a lottery. You pay some amount (it may be large or small) for the small chance to win back your health.

[Record all questions and comments here:]

c. Would you be willing to pay something for this drug?

Yes No Not sure

If not sure [PROBE]:

d. What is the highest amount you would be willing to pay for a one in 100 chance of a complete cure? [PAUSE] In other words, what is the highest amount would have to pay before you would turn down the opportunity to take the drug?

$_____ can't answer refusal nothing everything

PROBE: What were you thinking about when you answered?

If Unsure, hard to say, don't know

IF UNSURE ENCOURAGE RESPONDENT:

Other people find this hard too. Think about it and give me your best guess. PAUSE Is there anything about this situation that you are unsure about or that bothers you? RECORD CONCERNS HERE

IF NOT WORTH ANYTHING (volunteered)

Why is this? RECORD REASONS HERE

Now suppose that it becomes known that people with your particular characteristics (sex, age, etc.) are more likely to be cured by the drug. Say that your chance of a cure has increased from 1 in 1000 to 2 in 1000.

Here's the same picture as before except two squares are blackened.

[Then, SHOW CARD B]

e. Would you be willing to pay more, less, or the same as in the question above?

more less the same as not sure

f. What is the most you would be willing to pay for this 2 in 100 chance of a cure?

[IF RESPONDENT IS HAVING TROUBLE ANSWERING.SAY: THIS IS A HARD QUESTION, TOO. IS THERE ANYTHING YOU ARE UNSURE ABOUT OR IS TROUBLING YOU?] RECORD YOUR COMMENTS AND RESPONDENT'S COMMENTS HERE.

1 $_____ 2 Can't answer 3 refusal 4 everything

****

15. The next set of questions is even more hypothetical. Remember back to the time just before you knew you had the disease and before it started to bother you.

a. What year was this? _____

b. How old were you? _____

c. How was your health?

excellent good average fair poor

d. Did you smoke? Yes No Can't remember

e. Were you,married? Yes NO

f. If married, did you have children? Yes No

g. Were you employed outside-the home? Yes No

Think about your income and your total family income at that time

Think about your lifestyle at that time.

What did you know about [insert key respiratory disease here] at that time?

[Record Comments]

Suppose that 3 in 100 people [vary] with your characteristics (age, sex, smoking habits, stress levels, weight, etc) could be expected to get the disease over their lifetime. Put another way, before you got the disease, a doctor would have told you that your chances of getting it were 3 in 100.

Here's a picture of a three in 100 chance. There are 100 squares, each representing a person who, at the time, did not have [enter respondent's disease here]. The 97 blank squares represent people who will not get the disease. The 3 black squares represent people who will get the disease. At the time we are considering you had no idea that you would be represented by one of the blackened squares.

Now suppose that the wonder drug can definitely protect a person from getting the disease. That is, it can reduce the chance of getting the disease for a person who as yet doesn't have any symptoms and who has not been told by a doctor that they have a chronic respiratory disease from 3 in 100 to 0 in 100. In terms of our picture, if you took the drug back before you had the disease you would have been represented by one of the blank squares.

h. If at the time before you realized you had a chronic respiratory disease, a doctor had offered you a chance to take the drug that would have prevented you from getting the disease, would you have been willing to pay something for this sure thing? Remember, we want you to place yourself back in time and respond to this hypothetical situation the way you think you would have back then, before you knew what you know now about the disease.

Here's a card [C] that summarizes this situation. Please look at it and tell me if you have any questions.

[GO OVER CARD C WITH RESPONDENT POINTING OUT ITS FEATURES AND RECORDING ALL QUESTIONS AND COMMENTS MADE BY THE RESPONDENT. [Record all questions and comments here:]

Yes No Not sure Refusal

[ENCOURAGE RESPONDENT:

Other people find this hard too. PAUSE Is there anything about this situation that you are unsure about or that bothers you? RECORD CONCERNS HERE]

If Yes or **No**

Why is this? RECORD REASONS HERE

1. What is the most you would have been willing to pay to **take** this drug?

[IF RESPONDENT IS HAVING TROUBLE ANSWERING SAY: THIS IS A HARD QUESTION, TOO. IS THERE ANYTHING YOU ARE UNSURE ABOUT OR IS TROUBLING YOU?] RECORD YOUR COMMENTS AND RESPONDENT'S COMMENTS HERE.

1 $_____ 2 can't answer 3 refusal 4 everything

*****

16. Next, we want to ask you the **same** question except for one feature. The drug might not have worked for everyone. The doctors figure that by taking the drug you could have reduced your chances of getting the disease from 3 in 100 to 2 in 100.

Here is the picture of the.3 in 100 chance again. And here is a picture of the 2 in 100 chance. Thus, the drug could make it less likely that you would be represented by a blackened square.

a. If at the time before you realized you had **a** chronic respiratory disease, **a** doctor had offered you **a** chance to take the drug that would have reduced your **chances** of getting the disease, would you have been willing to pay something for this drug? Remember, we want you to place yourself back in time and respond to this hypothetical situation the way you think you would have back then, before you knew what you now know about the disease.

SHOW CARD **D**

Yes **No** **Not** sure Refusal

If not sure
[ENCOURAGE RESPONDENT:

Other people find this hard too. PAUSE Is there anything about this situation that you are unsure about or that bothers you? RECORD CONCERNS HERE]

If Yes or **No**
Why is this? RECORD REASONS HERE

b. Would it have been more or less than you answered before when the drug was certain to prevent the disease?

1 more 2 about the same 3 less 4 don't know 5 other (specify)

c. What is the most you would have been willing to pay for this drug?

[IF RESPONDENT IS HAVING TROUBLE ANSWERING SAY: THIS IS A HARD QUESTION, TOO. IS THERE ANYTHING YOU ARE UNSURE ABOUT OR IS TROUBLING YOU?] RECORD YOUR COMMENTS AND RESPONDENT'S COMMENTS HERE.

1 $_____ 2 Can't answer 3 refusal 4 everything

****

Finally, we want to ask you the same question except for one feature. You answered above excluding what you have learned about the disease and its consequences for your life since you have gotten the disease. **Now,** we want you to answer on the basis of your knowledge and experience with the disease. That is, we want you to place yourself in a time just before you' realized you had your disease but with the knowledge and experience you now have about how such a disease could affect your life. Remember, this drug may not work and, at the time, your chance of getting the disease was very small. Specifically, without the drug you chance of getting the disease was 3

in 100. With the drug, your chance of getting the disease would have fallen to 2 in '100.

SHOW CARD E

d. Would you have been willing to pay something for the drug at the time before you realized you had this disease?

Yes **No** Not sure

If not sure
[ENCOURAGE RESPONDENT:

Other people find this hard too. PAUSE Is there anything about this situation that you are unsure about or that bothers you? RECORD CONCERNS HERE]

If Yes or No
Why is this? RECORD REASONS HERE

e. Would it have been more or less than you answered before when you answered on the basis of the knowledge you had about the disease before you got it?

1 more 2 about the same 3 less 4 don't know 5 other (specify)

f. What is the most you would have been willing to pay for. this drug?

[IF RESPONDENT IS HAVING TROUBLE ANSWERING SAY: THIS IS A HARD QUESTION, TOO. IS THERE ANYTHING YOU ARE UNSURE ABOUT OR IS TROUBLING YOU?] RECORD YOUR COMMENTS AND RESPONDENT'S COMMENTS HERE.

1 $_____ 2 Can't answer 3 refusal 4 everything

*****

Current Health

Now I'd like to ask you some questions about the current state of your disease.

17. Thinking back over the past year, about how many hours of distress do you have during a-bad day? (By distress I mean feeling more than mildly uncomfortable, By bad days I mean those days when you feel as bad as you ever feel without going to the hospital for treatment.)

a. _____ hours of distress on a bad day

About how many hours of distress did you have last week?

b. _____ hours of distress last week

On a bad day, how many steps can you walk up without having to pause to catch your breath?

c. _____ steps (15 steps = one.flight, 8 steps = half a flight)

How about on an average day?

d. _____ steps (15 steps = one flight, 8 steps = half a flight)

How about a good day (i.e., the best you ever feel)?

e. _____ steps (15 steps = one flight, 8 steps = half a flight)

18. Now a want to ask you a series of questions about your condition with answers of

1 very much 2 somewhat 3 very little 4 not at all 5 Don't Know

(SHOW CARD)

Your answers should refer to your problems with your condition and side effects of drugs you must take, but not problems occurring during recovery from operations. During an average day

a. Does weakness or lack of strength bother you enough to be a problem? _____

b. What about tiredness, lack of energy? _____

c. Shaky hands? _____

d. Muscle spasms? _____

e. Bruises? ____

f. Pain? ____

IF YES to Pain

1. Where do you have this pain?

_____

2. IF CHEST PAIN

a. Is this a burning chest pain?
1 Yes 2 Sometimes 3 No 4 DK

b. Is it a pressing pain?
1 Yes 2 Sometimes 3 No 4 DK

c. Is it brought on by work or exercise?
1 Yes 2 Sometimes 3 No 4 DK

d. Does it get better when you rest?
1 Yes 2 Sometimes 3 No 4 DK

e. Is it brought on by nervous tension?
1 Yes 2 Sometimes 3 No 4 DK

f. How often do you have chest pains?

_____

3. Can you get relief from pain by taking medication?
1 Yes 2 Sometimes 3 No 4 DK

19. On a bad day, do you have a 1 great deal (includes unable), 2 fair amount, 3 some, 4 little or 5 no trouble when you try to . . . (SHOW CARD)

a. Sit for long periods ____

b. Walk for long distances ____

c. Use stairs or inclines ____

d. Stand for long periods ____

e. Stoop, crouch or kneel ____

f. Reach ____

g. Use fingers to grasp or handle ____

h. Lift or carry something as heavy as 10 pounds, such as a 10 pound sack of potatoes ____

i. Lift or carry 25 pounds such as two full bags of groceries ____

******

Occupation

21. Do you have a full or part time job outside the home?

1 Yes full 2 Yes part 3 Unemployed 4 Retired 5 Homemaker 6 Other (_____)

IF retired:

a. at what age? _____

b. Did you retire early?

1 Yes 2 No

If YES:

c. Did you retire early because of your condition?

1 Yes 2 partly 3 No 4 not sure

If YES to full or part:

d. What work do you do? (probe to get type of job and company)

e. Is this the same job you held when you were first diagnosed as having a chronic lung disease?

1 Yes, same job 2 Yes, but it used to be full time, now part time 3 No 4 Other (specify)

f. How many hours a week do you work now? _____hours

g. How many weeks per year? _____weeks per year

h. When do you plan to retire?

19_____

i. How old will you be then?

_____ years old

IF **NO** to e.:

h. What was your former job? (probe to get type of job and company)

i. Why did you change jobs?

1 Because of disease 2 Partially because of disease 3 Other

****

Activities

22. Please answer yes or no to the following questions.

a. Do you have to stay in bed at least occasionally because of your condition?

1 Yes 2 No 3 DK

b. Do you ever need help to wash and dress?

1 Yes 2 No 3 DK

c. Do you have to stay in a chair or wheelchair at least occasionally?

1 YES 2 NO 3 DK

d. Does your condition at least occasionally prevent you from getting out of doors by yourself?

1 Yes 2 No 3 DK

e. Does your condition at least occasionally prevent you from engaging in leisure activities outdoors?

f. Does your condition at least occasionally prevent you from using public transportation such as buses and trains by yourself?

1 Yes 2 **No** 3 DK

g. Do you currently have a driver's license?

1 Yes 2 No 3 DK

h. Do you own a car?

1 Yes 2 **No** 3 DK

i. Does your condition ever prevent you from driving a car?

1 Yes 2 No 3 DK

IF NO

1. How many miles per week do you drive, on average?

_____miles per week.

****

Smoking

22. Have you smoked at least 100 cigarettes (5 packs) in your entire life?

1 Yes 2 **No** 3 DK

(IF no go to Background)
IF YES

a. Do you smoke cigarettes now?

1 Yes 2 **No** 3 DK

(If NO go to 22.a.3) .
IF **YES**

1. On average, how many cigarettes a day do you smoke?

_____ cigarettes a day

2. Is this more, the same, or less than the number of cigarettes you **were** smoking when you were first diagnosed as having lung disease?

1 More 2 Same 3 Less 4 DK

GO TO Background

3. When did you stop smoking? 19___

4. On the average, how many cigarettes a day did you **smoke** before you stopped?

_____ cigarettes a day

****

Background

23. Sex 1 **Male** 2 Female

24. What year were you born? 19___

25. What is the last grade of formal education you have completed?

1 Less than high school graduate
2 High school graduate
3 Some college/business school
4 Bachelors Degree
5 Masters Degree
6 Ph.D
7 Refused

26. How many people including yourself live in your household?

_____ people including myself

27. Please look at this card [CARD **I-2**] and tell me the letter next to the category that includes your total household income (before taxes) for the last year?

A	1	$0 to 6,000
B	**2**	6001 to 8000
C	**3**	8001 to 11000
D	**4**	11001 to 15000
E	**5**	15001 to 20000
F	**6**	**20001** to 25000
G	**7**	25001 to 30000
H	**8**	30001 to 40000
I	9	40001 to 50000
J	10	More than 50000
	11	Refused

t
CARD I-2

CURRENT HOUSEHOLD INCOME BEFORE TAXES FROM ALL SOURCES

A $0 to 6,000
B 6,001 to 8,000
C 8,001 to 11,000
D 11,001 to 15,000
E 15,001 to 20,000
F 20,001 to 25,000
G 25,001 to 30,000
H 30,001 to 40,000
I 40,001 to 50,000
J More than 50,000

We asked you a number of questions pertaining to the time you first noticed you had this disease. Look at this card and tell me the letter next to the category that includes your total household income (before taxes) for that-year? [HAND RESPONDENT CARD I-l) [PAUSE] Just your best guess.

A	1	$0 to 3,000
B	2	3001 to 5000
C	3	5001 to 7000
D	4	7001 to 9000
E	5	9001 to 12000
F	6	12001 to 15000
G	7	15001 to 18000
H	8	18001 to 24000
I	9	24001 to 30000
J	10	30000 to 40000
K	11	40000 to 50000
L	12	More than 50000
	13	Refused, don't know

CARD I-l

IN THE YEARS JUST BEFORE YOU
FIRST REALIZED YOU HAD LUNG DISEASE:

ANNUAL HOUSEHOLD INCOME BEFORE TAXES FROM ALL SOURCES

1 $0 to 3,000
2 3001 to 5000
3 5001 to 7000
4 7001 to 9000
5 9001 to 12000
6 12001 to 15000
7 15001 to 18000
8 18001 to 24000
9 24001 to 30000
10 30000 to 40000
11 40000 to 50000
12 More than 50000

Exhibit C

Francis Scott Key Medical Center
a Johns Hopkins Medical Institution

4940 Eastern Avenue
Baltimore, Maryland 21224

DEPARTMENT OF MEDICINE

Division of Pulmonary Medicine
Telephone: (301) ~~955-0545~~ 550-0809

October 18, 1988

Dear Patient,

Resources for the Puturt is a non-profit research group based in Vashington, D.C. which investigates matters of environmental health, air pollution, and natural resources.

They have contacted us to help in a project funded by the U.S. Environmental Protection Agency to dtttraint the social costs of chronic respiratory disease - primarily chronic bronchitis and emphysema. They have asked us to contact our patients about the possibility of participating in an at-home inttrvltv about their lung disease and the impact it has had on their lifestyle. The results of the study will be published in a research report. However, to maintain confidentiality, none of those interviewed will be identified by name.

I have identified you and other Individuals in-our patient list as potential participants. I hope you can help us out. Please read the information tnclostd and return the response form to Resources for the Future in the stamped prt-addressed envelope.

Your participation is voluntary. If you can help us out, it would be great! If it is not possib e, i.e. ethe please be assured that your treatment here at the hospital will never be Influenced by your decision not to participate. Please call me (at 550-0809) or MaryAnn Hiteshew (550-0560) if you have any questions about our role in this study.

Sincerely,

Noreen McMahon, RN
Clinical Coordinator/
Pulmonary Liason

October 18, 1988

Dear Survey Candidate,

You have been chosen as a candidate for participation in an in-person survey on the effects of chronic respiratory disease on your daily life. **The** interview will take about 40 minutes and will be conducted at your home, at a time convenient to you. The interview will take place in early November.
This survey is part of a larger project to determine the costs of chronic bronchitis and emphysema funded by the U.S. Environmental Protection Agency. Your participation in this survey will provide essential information on the consequences of respiratory diseases for everyday living. Ultimately, your participation will lead to better government policies for protection of the environment and for health cart. Resources for the Future, a non-profit research organization based in Washington, **D.C.,** is conducting this study. A brochure describing our organization is enclosed.

As you can see from the cover letter, Francis Scott Key **Medical** Center has been helping us with this study. Your records show that you have chronic bronchitis or emphysema (and possibly other diseases). If you do not have chronic bronchitis or emphysema, please write your name in the space provided on the enclosed form, circle the respiratory diseases you do have, and mail the form to us in the stamped, pre-addressed envelope.

If you do have chronic bronchitis or emphysema, please indicate on the enclosed form whether you would like to participate in this study. If you would like to **be** interviewed, answer all of the questions on the form, and return it to us in the pre-addressed and stamped envelope. You will be called soon to set up an interview. If you do not wish to participate, simply write your name in the space provided, check the box next to the statement saying that you do not want to participate, and mail this form to us in the prt-addressed and stamped envelope. If you do not respond, we may contact you by mail or phone to see if you are interested in participating. Participation in. this survey is completely voluntary. All responses will be confidential and no participants in the survey will be named in the report.

Please feel free to call me collect if you have any questions.

Sincerely,

Alan J. Krupnick, **PhD**
Project Leader (Call Collect: 202-328-5107)

RESPONSE FORM

Name : _____

What lung diseases do you have? (Please circle as many as apply)

Chronic bronchitis

Emphysema

Asthma

Other respiratory disease _____

Art you a member of a Better Breathing Club? _____

****

For those with chronic bronchitis or emphysema: (check one)

____I want to participate in the survey.

____I do not want to participate in the survey.

****

If you want to participate, please complete the following questions.

Phone Number: _____

Convenient time of day for us to call you: _____

Address :

Street _____

City _____ State _____ Zip Code _____

Exhibit D

AMERICAN LUNG ASSOCIATION of Maryland, Inc.
The Christmas Seal People®

1301 York Road, Suite 705
Lutherville, Maryland 21093
(301) 494-1100
(800) 492-7527

James L. Baer, President
Joyce C. Waite, Executive Director

September 12, 1988

Dear Lung Association Friend:

As you know, the American Lung Association of Maryland is always striving to learn more about the impact of lung disease.

Recently, we agreed to cooperate with a local, non-profit, research organization, Resources for the Future, to help them research the costs of emphysema and chronic bronchitis.

To maintain your confidentiality, information about the research study is being sent to you directly from the Lung Association.

You are not obligated to participate in the research study. But your experience and first-hand knowledge would be invaluable and richly appreciated.

Please read the information enclosed and return the response form to Resources for the Future.

Cordially,

Patricia A. Brady
Staff Coordinator,
Adult Lung Disease

PAB/mi

Enclosures

September 1, 1988

Dear Survey Candidate,

You have been chosen as a candidate for participation in an in-person survey on the effects of chronic respiratory disease on your daily life. The interview will take about 40 minutes and will be conducted at your home, at a time convenient to you. The interview will take place in mid to late September.

This survey is part of a larger project to determine the costs of chronic bronchitis and emphysema funded by the U.S. Environmental Protection Agency. Your participation in this survey will provide essential information on the consequences of respiratory diseases for everyday living. Ultimately, your participation will lead to better government policies for protection of the environment and for health care. Resources for the Future, a non-profit research organization based in Washington, D.C., is conducting this study. A brochure describing our organization is enclosed.

Only those people with chronic bronchitis or emphysema are eligible to participate in the interview. If you do not have chronic bronchitis or emphysema, please write your name in the space provided on the enclosed form, circle the respiratory diseases you do have, and mail the form to us in the stamped, pre-addressed envelope.

If you do have chronic bronchitis or emphysema, please indicate on the enclosed form whether you would like to participate in this study. If you would like to be interviewed, answer all of the questions on the form, and return it to us in the pre-addressed and stamped envelope. You will be called' soon to set up an interview. If you do not wish to participate, simply write your name in the space provided, check the box next to the statement saying that you do not want to participate, and mail this form to us in the pre-addressed and stamped envelope. If you do not respond, we may contact you by mail or phone to see if you are interested in participating. Participation in this survey is completely voluntary.

Please feel free to call me collect if you have any questions.

Sincerely,

Alan J. Krupnick, PhD
Project Leader (Call Collect: 202-328-5107)

D-3

RESPONSE FORM

Name : _____

What lung diseases do you have? (Please circle as many as apply)

Chronic bronchitis

Emphysema

Asthma

Other respiratory disease

Are you a member of a Better Breathing Club? _____

****

For those with chronic bronchitis or emphysema: (check one)

___ I want to participate in the survey.

___ I do not want to participate in the survey.

****

If you want to participate, please complete the following questions.

Phone Number: _____

Convenient time of day for us to call you: _____

Address :

Street _____

City _____ State _____ Zip Code _____

Exhibit E

January 12, 1988

Dear Survey Candidate,

You have been chosen as a candidate for participation in a telephone survey on the effects of chronic respiratory disease on your daily life. The interview will take about 10 minutes and be conducted at a time convenient to you. The interview will take place in February.

This survey is part of a larger project to determine the costs of chronic respiratory disease that is being funded by the U.S. Environmental Protection Agency. Resources for the Future, a non-profit research organization based in Washington, D.C., is conducting this project. A brochure describing our organization is enclosed. Your participation in this survey will provide essential information about the consequences of respiratory diseases for everyday living. Ultimately, your participation will lead to better government policies for protection of the environment and for health care.

Another part of this project involves a survey of people who do not have a respiratory disease but have a good idea about the consequences of these diseases for a person's daily life. For this survey we would like to contact one or more of your relatives living in the area who are familiar with your disease. We plan to ask your relatives about their health and the concerns they have about developing chronic respiratory disease.

You are eligible to participate if you have:

1) a chronic respiratory disease (emphysema, chronic bronchitis, asthma, etc.) and
2) at least one relative (for example, a son, daughter, grandchild, or spouse) living in Maryland, Delaware, the District of Columbia, or Virginia.

Whether you are eligible or not and whether you would like to participate or not, please write your name on the enclosed form. Then indicate the chronic diseases you have and whether you have a relative in the area who is familiar with your disease.

If you would like to be interviewed, answer all of the questions on the enclosed form, provide your phone number, and return the form to us in the pre-addressed and stamped envelope. During our call to you we will ask you for the names and addresses of relatives in the area. We will then send them a letter asking them if they would like to participate in our survey. Participation in the survey by you and your relatives is completely voluntary.

If you are ineligible to participate or do not want to be interviewed, please mail the form to us in the stamped, pre-addressed envelope. Be sure that you have filled in your name, so that we will know not to contact you again.

If you do not respond, we may contact you again to see if you are interested in participating.

Please feel free to call me collect if you have any questions.

Sincerely,

Alan J. Krupnick, PhD
Project Leader (Call Collect: 202-328-5107)

E-3
RESPONSE FORM

Name: _____

YOU ARE ELIGIBLE TO PARTICIPATE IF YOU HAVE A CHRONIC RESPIRATORY DISEASE AND A RELATIVE LIVING IN THE AREA.

1. Do you have a chronic respiratory disease?

   ___Yes, ___No

   If Yes, what respiratory diseases do you have? (Please check as many as applicable)

   __Chronic Bronchitis, __Emphysema, -Asthma, __Other respiratory disease

2. Do you have at least one relative living in Maryland, Virginia, DC, or Delaware who is familiar with your disease?

   ___Yes, ___No

IF YOU ANSWERED NO TO ONE OR BOTH OF THE ABOVE QUESTIONS, YOU ARE INELIGIBLE TO PARTICIPATE IN THE SURVEY. PLEASE SEND THIS FORM TO US IN THE STAMPED SELF-ADDRESSED ENVELOPE.

****

IF YOU ANSWERED YES TO THE ABOVE QUESTIONS, PLEASE INDICATE WHETHER YOU WOULD LIKE TO PARTICIPATE IN THE SURVEY:

____I want to participate in 'the survey.

____I do not want to participate in the survey.

****

IF YOU WANT TO PARTICIPATE, PLEASE PROVIDE:

Phone Number: _____

Convenient time of day for us to call you: _____

Address:

_____

city_____ State_____ Zip Code_____

Please note the sex, approximate age, and the relationship to you of your relatives living in the area (child, spouse, etc.). Note whether they have a chronic respiratory disease.

	Relationship	Age	Sex (M/F)	Chronic Disease (Yes/No)
Relative 1		-	-	
Relative 2				
Relative 3		-	-	
Relative 4		-	-	

Exhibit F

Notes on B's reaction to the questionnaire.

1) Needed some orientation on keyboard layout. For people **really** unfamiliar with this we could develop a mask. Only four **keys** are needed.

2) Had some trouble with city choice scenario. Said, **"Air** is rotten everywhere.

3) Dissonance when description **of** the disease said no premature mortality and no medical costs. Dad died **early because** of this disease and mom expected to. Medical costs are covered 80% not 100%.

4) Resistance to smoking questions. She's been urged to quit but is militantly against quitting.

5) Some of the questions that elicit preference to avoid disease consequences are difficult to answer because of no experience. Wording could be improved.

6) Inability to answer miles driven **per week**

7) Subject prefers city **B with** lowest CB risk. Choice made because she doesn't want a lingering death. Watched father and is watching mother die.

8) Indifference map **was** flat over much of the range.

9) reverse trade-off question answered consistently.

10) For COL question, said **"I'm** not a gambler. Don't believe in it." But, answered anyway.

11) Answer translates to Value of stat life of $80/5/100,000=$1.6 million.

Notes on S.

1) Subject questioned the controllability of chronic bronchitis. To the extent it is controllable she would favor the city with the lower auto death.

2) Nevertheless, she chose B (low CB risk) because she felt that the odds for auto death wouldn't apply to her, since she is a good driver.

3) She seemed to have a threshold model in mind when deciding to switch cities. That is, she didn't want to switch to quickly from favoring one city to favoring the other. This suggests that the size of the incremental change can influence the indifference point and that, in general, decisionmaking is driven by factors internal to the questionnaire rather than in the respondent's preference system.

4) When told that the implication of her indifference point (at 73) was that she valued avoiding CB at twice the value of avoiding auto death she was quite surprised and said that this tradeoff did not reflect her true tradeoff.

5) When confronted by the consistency check trade-off, she chose city B, the low auto death city. Her rationale for this "inconsistent" response was that city B had just better than half the baseline auto death rate (11 versus 20). Thus, the baseline probabilities influenced her choice. .

6) The COL trade-off was made at 74 because she felt that $80 was nothing. "I waste so much." Nevertheless, the implied VOL is $8 million.

Chapter 5
Risk Tradeoff Analysis

INTRODUCTION

Recent research on the value of reducing risk of chronic respiratory disease (Viscusi, Magat, and Huber, 1988 (VMH)) has used computer-interactive survey techniques to elicit tradeoffs: (1) between the risk of chronic illness and the risk of accidental death and (2) between the risk of chronic illness and income loss. These tradeoffs are motivated by having a subject identify his preference for living in one of two cities. that differ only in the above characteristics. Using a given value of a statistical life, choices in (1) can be converted to the willingness to pay for chronic illness risk reduction, while choices in (2) provide such estimates directly.

The VMH study chose respondents without regard to their prior knowledge of or familiarity with chronic respiratory disease, but provided them with a description of an abstract case of chronic bronchitis before the interview began. It is our contention that such limited familiarity with the disease does not provide a reliable basis for valuing chronic disease and that, in general, willingness-to-pay (WTP) estimates will be highly sensitive to the information, experience, and knowledge possessed by respondents as well as to the severity of the disease being described.

Our study estimates the effects of familiarity with and severity of chronic respiratory disease on risk-risk and risk-income tradeoffs. We interviewed healthy, adult relatives of adults with chronic respiratory disease. Half of the respondents valued the risk of chronic bronchitis as described by VMH (version I). The other half valued the risk of a case of chronic lung disease "like their relative's" (version II). Using additional questions about the characteristics of the relative's disease and the respondent's familiarity with it, we test the hypotheses that (i) individuals more familiar with chronic respiratory disease will value risk reductions of an abstract case differently than those unfamiliar with the disease (from the VMH survey), (ii) risk reductions for more severe cases

of chronic lung disease will be valued more highly than those for less severe cases, and (iii) individuals will value risk reductions for a case like the one they know (holding severity constant) more than such reductions for an abstract case.

After presenting the conceptual basis of the risk tradeoff approach and a description of the survey instrument and the sample, we address the first hypothesis by comparing our results to those of VMH. Next, we modify both samples based on alternative characterizations of inconsistencies to present adjusted estimates of WTP for chronic bronchitis risk reductions. Then, regression analysis is used to compare predicted WTP estimates corrected for sample differences. Finally, familiarity variables are introduced into the regression model to test whether the degree of familiarity with chronic lung disease affects WTP.

Hypothesis two is then examined after defining disease severity in a variety of ways and using such variables to help explain variation in WTP for both the version I and the version II samples. The third hypothesis is examined by comparing WTP responses across the version I and version II samples and pooling the samples in a regression analysis.

THEORETICAL MODEL

Risk-Risk Tradeoffs

The purpose of confronting respondents with risk-risk and risk-income tradeoffs is to elicit their willingness to pay for an exogenous change in risk of chronic bronchitis, i.e., the rate at which they are willing to trade income for bronchitis risk. The risk-risk tradeoffs (termed tradel and trade2) are based on a model in which there are three health states: death in an auto accident (D), having chronic bronchitis (C) and being healthy (H). Utility in each state is a function of income, I, and the state itself, thus utility conditional upon being healthy is U(H,I). Letting X denote the probability of having chronic bronchitis and Y the probability of accidental death, expected utility is given by

$$E(U) = XU(C,I) + YU(D,I) + (1-X-Y)U(H,I). \quad (1)$$

The individual's willingness to pay for a marginal change in X, i.e., the rate at which he is willing to trade I for X holding expected utility constant, is the difference in utility between being healthy and having chronic bronchitis, divided by the expected marginal utility of income,

$$-\frac{dI}{dX} = -\frac{\partial E(U)/\partial X}{\partial E(U)/\partial I} = \frac{U(H,I) - U(C,I)}{\partial E(U)/\partial I}. \qquad (2)$$

To estimate (2) VMH make use of the relationship between willingness to pay for a change in probability of chronic bronchitis and willingness to pay for a change in probability of death,

$$-\frac{dI}{dY} = -\frac{\partial E(U)/\partial Y}{\partial E(U)/\partial I} = \frac{U(H,I) - U(D,I)}{\partial E(U)/\partial I}. \qquad (3)$$

To see how the two are related, suppose that the individual considers the (risk of chronic bronchitis, risk of death) pair (X_A, Y_A) equivalent to (X_B, Y_B), i.e., the two yield the same expected utility,

$$X_A U(C,I) + Y_A U(D,I) + (1-X_A-Y_A)U(H,I) = X_B U(C,I) + Y_B U(D,I) + (1-X_B-Y_B)U(H,I). \qquad (4)$$

Equation (4) implies that

$$U(H,I) - U(C,I) = t[U(D,I) - U(C,I)], \qquad (5)$$

where $t = (Y_B-Y_A)/(X_A-X_B)$ is the rate at which risk of death can be traded for risk of chronic bronchitis, keeping expected utility constant. Thus, equations (2), (3) and (5) imply that willingness to pay for a change in risk of chronic bronchitis equals t times willingness to pay for a change in risk of instantaneous death.

$$-\frac{dI}{dX} = -t\,\frac{dI}{dY} \qquad (6)$$

VMH obtain -dI/dY from compensating wage studies and elicit t as indicated in figure 5-l. Suppose an individual is initially confronted with two risk-risk pairs (X_A, Y_A) and (X_B, Y_B) (in the figure shown as (75,15) at point A and (55,19) at point B, in units of 100,000), corresponding to risks of chronic bronchitis and death in two cities. If initially (X_B, Y_B) is preferred to (X_A, Y_A) then Y_B is held constant (at 19) and X_B is raised until the individual is indifferent between (X_A, Y_A) and (X_B^*, Y_B) ((65,19) at point C).

Risk-Income Tradeoffs

A disadvantage of the above procedure is that it requires extraneous estimates of the rate of substitution between income and risk of death. To avoid this, VMH also confront respondents with risk-income tradeoffs (termed trade3). To see how these can be interpreted, suppose that the probability of accidental death is zero (Y=0) and suppose further that the marginal utility of income is constant and independent of health state. Equation (1) then reduces to

$$E(U) = XU(C) + (1-X)U(H) + \alpha I, \tag{7}$$

where a is the marginal utility of income. Willingness to pay for an exogenous change in X is still given by (2), where $\partial E(U)/\partial I = \alpha$. Suppose that the individual considers the risk-income pairs (X_A, I_A) and (X_B, I_B) equivalent, i.e., they yield the same expected utility,

$$X_A U(C) + (1-X_A)U(H) + \alpha I_A = X_B U(C) + (1-X_B)U(H) + \alpha I_B. \tag{8}$$

Equation (8) implies that

$$\frac{U(H)-U(C)}{a} = \frac{I_B - I_A}{X_B - X_A}. \tag{9}$$

Hence, given equivalent risk-income bundles, one can compute willingness to pay for a change in X.

SURVEY DESCRIPTION

Two surveys (Versions I and II) were developed and administered, with each person randomly assigned to a version of the survey. The protocol and survey for Version I are identical to those used by VMH with the addition of a set of computer-interactive questions appended to the end of the survey. The VMH protocol involved acquainting the respondent with the computer, reading them a description of the case of chronic bronchitis (Annex A), and showing them pictures of individuals with this disease as well as the breathing apparatus that is sometimes used (Annex B). Then, the survey was administered.[1] The program asks for information on personal characteristics, including smoking habits, exercise, health status, feelings about avoiding 13 consequences of chronic bronchitis (on a 49 point scale), the risk-risk and risk-income tradeoffs, and a series of questions about insurance and income.

The tradeoff questions are the heart of the program (see annex C). In the first tradeoff (tradel), individuals are given the choice of moving to one of two areas, each with lower risks of developing chronic bronchitis and of dying in an auto accident than in their current area of residence.[2] Respondents are first given a dominant choice tradeoff, where risks of both auto death and chronic bronchitis are lower in one city than in the other. Individuals are not permitted to proceed with the survey until they choose the dominant city. In our sample, 92 percent chose the dominant city the first time, and none failed to ever make the correct choice (and be dropped from the sample). In contrast VMH found that "over 80%" gave a correct initial response, while less than one percent had to be dropped.

---

1. VMH used several versions of their questionnaire. Of relevance to our study are questionnaires A and C. Questionnaire A contains the same tradeoff questions as our version I. Questionnaire C contains tradeoff questions corresponding to our trade1 and trade2.

2. Respondents are told that these probabilities are estimated based on responses to previous questions (such as those on smoking), but in reality all respondents are provided with the same initial risk levels.

The next series of questions involves the choice between city A and B, with city A having greater risks of chronic bronchitis (75/100,000 versus 55/100,000) but lower risks of auto death (15/100,000 versus 19/100,000) than city B. Respondents could indicate the strength of their preference for one city over another by moving a cursor along a line, with the cursor initially placed by the computer in the middle of the line at a point of indifference (annex C). After the response, the tradeoff is made less favorable for the chosen city and the respondent chooses cities again. These pairwise comparisons (each of which is called a subtrade) are made until a point of indifference or a switch in preferred city is registered.

The nature of the tradeoff can be examined further with the aid of figure 5-l. This figure shows indifference curves for chronic bronchitis risk and auto death risk (in units of 100,000ths). Expected utility rises as one moves closer to the origin. The figure depicts a situation where the individual initially chooses city B. We know this because the indifference curve through the bundle (55,19) is closer to the origin than the curve through the bundle (75,15). Holding the city A bundle constant, the program progressively worsens conditions in city B until the individual indicates indifference at a point such as C (65,19), by definition on the same isopleth as the bundle for city A. The slope connecting these two points ((19-15)/(65-75)) is the tradeoff t.

The second tradeoff (trade2) also involves chronic bronchitis and auto death risks. In trade2, the initial risks are changed in city B so that (1) the initial relative risks are identical to those in trade1 and (2) a respondent who preferred city A in trade1 should prefer city B in trade2 (unless the initial conditions cause the interpretation of the risks to differ), i.e., chronic bronchitis risks in B are raised above those in city A (75/100,000 for A versus 95/100,000 for B) while auto death risks are lowered (15/100,000 versus 11/100,000). If city B is chosen, auto death risk in B is steadily raised until indifference is reached.[3] Trade2 can be

3. As noted by VMH, if individuals are more concerned about avoiding a given increase in risk than obtaining a decrease in risk of the **same** size, then t for the trade1 should be less than t for the trade2

viewed as a check on the response to tradel, as a more valid response than that to trade1 because of learning by doing, or as a different question altogether because of changes in the magnitude of the initial risks and whether risks increase or decrease to move the subject towards indifference.[4]

The third tradeoff (trade3) is between chronic bronchitis and the cost of living, i.e., income. Individuals choose between city A and B where A has a higher risk of bronchitis than B (75/100,000 versus 55/100,000) but a lower cost of living (COL) (A has the same COL as the respondent's current place of residence; B's COL is $80 higher). The risk of chronic bronchitis or the COL is progressively changed in B (depending on which city is initially chosen) until indifference or a switch in preferred city is registered.

Several parameters associated with these trades, such as the initial risk levels and COL differentials between the cities and the value of a statistical life ($2 million), were chosen to obtain a degree of response consistency across trades. With these assignments, if a subject indicates indifference to the initial subtrade of any of the three trades, the implied value of a statistical case of chronic lung disease (VOCL) is $400,000. If a subject initially prefers the city with the lower chronic disease risk and maintains this preference until just before the cities offer identical risks of chronic lung disease, the implied VOCL is $8 million (the maximum value possible). If a subject initially prefers the city with the lower auto death rate and maintains this preference until the subtrade before auto death risk in the cities is equal, the implied VOCL is $10,000 for trade1 and trade2 and $5,000 for trade3 (the minimum possible VOCLs).

The set of questions that we added to the VMH survey elicit descriptions of the types and severity of the relative's chronic disease as perceived by the respondent and the respondent's familiarity with these

4. Note that with conventional expected utility theory, no difference in tradeoffs (t) between trade1 and trade2 would be predicted.

conditions. The severity of respiratory diseases is measured in several different ways. Standard questions meant to measure severity were taken from the British Medical Questionnaire and similar questionnaires. Several of these questions measure the severity of cough, wheezing, pleghm, and breathlessness.

Familiarity is also measured in alternative ways. Examples of these include: a dummy variable that equals one if the relative is a parent, child, spouse or sibling and zero otherwise, a response to a direct question about the respondent's familiarity with their relative's disease, and questions about how often the respondents sees and talks to the relative and whether they live with the relative. Also, to establish familiarity with automobile accidents, respondents were asked if they had ever lost a close friend or relative in an auto accident (this question was also asked by VMH).

In version II of the survey, tradeoffs are elicited for risk reductions in a disease like the sick relative's. Therefore, the set of questions concerning the relative's disease is placed before the tradeoff questions. In addition, all questions referring to a "case of chronic bronchitis" are altered to read "a case of chronic respiratory disease like your relative's". Further, the respondent is asked about whether he is concerned about possible loss of income and premature death, two possible symptoms of chronic respiratory disease that were excluded from the case description given to the VMH and the version I samples. Finally, respondents were asked if their relative actually suffered from any of the symptoms or exhibited any of the characteristics mentioned by VMH (as well as income loss and premature mortality). Needless to say, the descriptions of chronic bronchitis offered to respondents taking version I were not given to those taking version II.

SAMPLE DESCRIPTION

Obtaining the Samples

Subjects were recruited in spring of 1989 from two ads placed in the Health Supplement to the Washington Post and from an ad in the Diamondback,

the newspaper of the University of Maryland, College Park. Callers were screened out for any of the following reasons: they had a chronic respiratory condition, were under 18 years old, or did not have a relative 21 or over with a chronic respiratory condition. Respondents passing the screen had a choice of taking the questionnaire at the Survey Research Center at the University of Maryland or at Resources for the Future. Every other subject taking the questionnaire was assigned the same version. Each respondent received $25. In all, 189 questionnaires were completed and properly recorded, 95 for version I and 94 for version II.

Descriptive Statistics

Statistics for key variables are provided in table 5-l for version I and the VMH survey. A full set of descriptive statistics and a correlation coefficient matrix involving all variables for both version I and version II is in annex D.

Comparing version I to VMH, there are many similarities and some striking differences in sample characteristics. Because many respondents in our sample were students, the average age was lower, as was the percentage married. Household size and income are larger for our sample, possibly due to differences in incomes in the Research Triangle Park area vs Washington, DC and the large relatively large proportion of our sample drawn from the UNiversity of Maryland staff and student body .

On the other hand, the samples from version I and II are very similar to one another in all respects, such as age (average of 25), sex (more males than females), education (some college), marital status (more not married than married), family income ($57,000), number of people in their household (3.5), and number of children (0.5). Differences between the samples include: smokers make up 25 percent of those taking version I, but only 17 percent of those taking version II; the version I group is somewhat more active (more than 3 hours of exercise a week versus 2.5) and drives somewhat more miles (but both samples are in the 10,000 to 14,000 mile range).

Inconsistencies

Answering the tradeoff questions is not easy. It is an unfamiliar task, even for the computer-literate, although with a test question and three similar tradeoff questions to answer, respondents get some practice and opportunity for learning as they go through the program. Therefore, it is essential to screen out respondents who, from their answers, appear not to have understood the tradeoff tasks. VMH faced this problem by defining five types of inconsistencies and excluding from a given tradeoff all who exhibited one or more of them. These inconsistencies, which we term VMH-inconsistencies, may be defined as follows:

(i) **preference for dominated city.** Subject kept favoring a given city on each subtrade even when it exhibited (on the last question) the identical risk in one dimension (say chronic bronchitis) and a higher risk in the other (auto death). In terms of the indifference map of figure 5-2, inconsistency (i) involves a subject still preferring city B even though he is at a point such as D, which is clearly dominated by A. This implies that the indifference map is not everywhere downward sloping, a violation of the usual rationality assumptions.

(ii) **indifference to dominated city.** The same problem as above except they were at a point of indifference on the last subtrade even though one city was preferable to the other in one dimension and equivalent in the other. The point D in figure 5-2 would be on the same (vertical) indifference curve as A.

(iii) **Flip-flop.** When exhibiting inconsistency (i), the respondent was automatically asked to start the tradeoff over. The second time through the respondent began by favoring a different city than he had favored before. This inconsistency involves revealing an indifference map as shown in figure 5-l (for the initial choice of city B), followed by the revelation of a map that would place the bundle at city A on the isopleth nearer the origin.

(iv) **Last ditch switch.** Subject preferred a city until the next to the last possible subtrade and then switched on the last subtrade to the other

(now dominant) city. While such behavior is not technically inconsistent, it makes computation of the tradeoff impossible. In terms of figure 5-2, the subject does not actually reveal a point of indifference with city A, revealing instead only that he prefers a point like E to the bundle at city A (but not a bundle like D with the same chronic bronchitis risk but higher auto death risk than city A).

(v) Continuous indifference. Subject is indifferent to cities irrespective of tradeoffs or subject is indifferent on the initial subtrade and on the following question (called the check question) which asks if the subject really is indifferent. The indifference map here consists not of different "lines", each representing a given level of expected utility, but of " thick" indifference curves where the initial and subsequent levels of chronic bronchitis risk (associated with with the same auto death risk) are equally preferred (see figure 5-4 below).

Table 5-2 provides inconsistency counts for each trade for version I and the VMH samples.[5] Version II inconsistencies are in an annex E. In version I, 43 of 95 subjects (45%) gave at least one inconsistent response in at least one trade. For VMH, the overall inconsistency rate was substantially greater -- around 64% had at least one inconsistency on at least one trade.' On any given trade, the inconsistencies were fewer, of course. In version I, from 19-26% of the subjects had at least one inconsistency, while for VMH, from 34-40% of the subjects gave at least one type of inconsistent response in a particular trade.

The large differences in the percentage of consistencies demand some explanation. Our subjects were in an environment more conducive to

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5. Analysis of the VMH program revealed a programming error that mistakenly left in some respondents with inconsistencies (i) and (iii). We re-ran the VMH programs to generate new results. Estimates of the implied value of a case of chronic bronchitis (VOCB) differ very little from the results published in VMH (1988), except in trade3, where the corrected VOCB is 6% larger. In the rest of our report the corrected VMH results are used.

6. 124/194 = 63% for group A. In groups A+C, over two trades, the inconsistency rate was 49%= 1911389.

concentration. They were administered the survey in a quiet room with the exclusive availability of a person to answer their questions. The VMH survey was administered in a shopping mall and not all, subjects were given exclusive attention. In addition, because our subjects had to make a special trip to take the survey and were getting paid, they may have treated the survey more seriously.

The extent of what can be termed the "mall" effect cannot be tested. However, some further indication of the lack of attention among subjects in the VMH sample can be obtained from examining the frequencies in which subjects made the same mistakes in subsequent trades. That is, of the total number of persons with an inconsistency of a given type, we examine what percent made the same mistake on two or on all three trades. Figure 5-3 provides a Venn diagram for inconsistency (v) for each sample to illustrate the idea.

Consider the version I sample. Of the four people who gave at least one type (v) inconsistent response in tradel, none made this mistake again on subsequent trades and only one of the seven who made this mistake on trade2 made this mistake again on trade3. This implies that learning was occurring. Contrast these results with those from questionnaire A of the VMH sample. Of the 15 people with this inconsistency on tradel, 9 of them made the same mistake on trade2, and 4 of these made this mistake on all three trades. Also, an additional 6 subjects made the same mistake on trade2 and trade3 (but not tradel).

Differences in consistency rates are actually even larger than those reported above because of the particular ways in which VMH defined inconsistencies. Although we will examine this in detail below, note that subjects feeling strongly about chronic disease or auto death are more likely to find themselves being “inconsistent” in (ii) or (iv) above. These individuals are more likely to find themselves preferring the city favoring the dimension they feel strongly about just before that city becomes dominated by the other city. Excluding such individuals may, therefore, bias average tradeoffs. Individuals with inconsistency (iv)

make up the largest class of inconsistencies (21 of 95 for version I and 45 of 194 for VMH).

Inconsistencies by type for version I. Only inconsistencies within the version I sample are discussed below. Numbers of inconsistencies for the VMH sample are all much larger. Details of the most important inconsistency (iv) will be examined later when adjusted VOCBs are computed.

Four individuals in version I had inconsistency (i) (one person had this inconsistency in two trades). Individuals making such a mistake the first time through a tradeoff series would redo the series. Thus, if the program permitted indefinite looping, individuals would be taking the questionnaire until they stopped exhibiting inconsistency (i). However, the program only permits one loop. Therefore, individuals with this inconsistency made the same mistake twice in the same trade. Of those that looped, only 2 in version I switched city preference, thereby committing inconsistency (iii).

Seven individuals in version I had inconsistency (ii). From debriefing after the interviews we learned that some individuals who began by preferring a given city and then reached indifference early in the sequence of subtrades became bored with the game and kept hitting <return> with the cursor at its initial point of indifference. These subjects evidently did not realize that the game would have ended had they moved the cursor to favor the other city. No subjects registered indifference to more than one subtrade (including the last).

Twenty-one subjects in version I had inconsistency (iv). All these subjects were caught preferring a city until it was dominated and then switched.

Finally, of 18 subjects on version I who were indifferent to all subtrades within a given trade (inconsistency (v)), most of these were indifferent to the initial sub-trade and the check question.

Probit Analysis

Probit regressions were run to determine if the presence of at least one VMH-inconsistency for subjects in the version I sample could be explained by the set of variables used by VMH. The results are presented in table 5-3 for each trade. Few variables are significant in any of these tests, with the exception of EDUCATION in trade2 and INCOME in trade3. Those with less education or less income were more likely to be inconsistent than those with more education or more income, respectively. VMH also find a negative income effect on the probability of an inconsistency and find, for two trades, that smokers are more likely to be inconsistent but in the other trade that non-smokers are more likely to be inconsistent. Also, in tradel, younger people are found to be inconsistent more often than older people.

HYPOTHESIS I

The first hypothesis is that individuals familiar with chronic respiratory disease will place a higher value on risk reductions of an abstract case of chronic bronchitis than individuals not familiar with respiratory disease. Testing this hypothesis involves comparing the VOCBs obtained from the version I sample to those obtained by VMH (using, in both calculations, a VOL of $2 million).

The simplest comparison is in terms of the percentages of subjects who, at the initial risk rates, preferred the city with lower bronchitis risks to the city with either lower auto death risk (trade1 or trade2) or lower COL (trade3). For version I in the three trades, 77, 77, and 79 percent of our VMH-consistent sample initially preferred moving to the low chronic bronchitis risk city, while for the VMH sample, only 72, 59, and 50 percent preferred this city. Thus, by this crude measure, a familiarity effect could be present.

This simple measure has serious drawbacks, however. It does not incorporate the strength and distribution of preferences across the samples and it does not adjust for differences in sample characteristics. The first drawback can be addressed by computing median and mean VOCBs. Table

5-4 provides this information (using a value of life (VOL) of $2 million) for the three trades in Version I and the corresponding three trades in VMH. Only VMH-consistent observations are included. In the discussion below, we focus on the median because of its insensitivity to outliers.

In trade2 and trade3, the VMH medians and means are substantially below those from Version I, with only the difference for trade3 -- $2.08 million per case of chronic bronchitis from our sample compared to $457,000 per case using the VMH sample[7] -- being statistically significant.

Comparing the results for tradel, the VMH median is actually higher than that for version I, although the means are almost identical. With a much higher percentage of version I subjects favoring the low chronic bronchitis city relative to VMH subjects, this result implies that those in the VMH sample who favored the low bronchitis risk city in trade1 felt more strongly about avoiding chronic bronchitis than those in the version I sample, on average, at least in trade I.

Overall, these results provide, at best, only weak support for hypothesis I.

An even better test of familiarity can be constructed by statistically correcting for sample differences. This can be done by regressing individual tradeoffs on personal and other characteristics, and using the regression coefficients along with either average values for the explanatory variables or values for each individual to estimate predicted average VOCBs or averages of the predicted individual VOCBs.

With two sets of regressions (one set for version I, the other for VMH) and two sets of samples, four pairings of models to samples can be made. Evidence in favor of hypothesis I is obtained if the predicted tradeoff obtained from the version I regression model applied to either sample

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7. If respondents were being perfectly consistent in stating their preferences across trade2 and trade3, the results for our analysis imply that the VOL exceeds $2 million, whereas VMH find that it substantially below $2 million.

exceeds the predicted tradeoff obtained by applying the VMH model to the corresponding sample. To examine these relationships the tradeoffs must first be explained in a regression analysis.

Explaining variation in tradeoffs in version I

Following VMH, for each trade we regressed the natural log of the subjects tradeoff (t) on the same set of variables used by VMH. Only variables differentially affecting the WTP for risk reductions of chronic bronchitis and auto death should affect trade1 and trade2, while factors differentially affecting the risk of chronic bronchitis and the marginal utility of money should affect trade3.

Table 5-5 provides our regression results for the three trades (along with the comparable results from table 16 in VMH (1988).[8] As found by VMH, few variables in the version I regressions are significant at even a 90 % level. Of those that are, smokers tend to have stronger preferences for avoiding chronic bronchitis risk relative to risk of auto death than non-smokers. One explanation is that smokers may consider themselves at higher risk of developing chronic respiratory disease than non-smokers. In explaining the chronic bronchitis-income tradeoff, only the number of children living in the household (KIDS) is significant, with larger numbers in the household associated with a greater WTP for avoiding chronic bronchitis risk.

Although these results are broadly consistent with VMH in the sense that few variables are significant, the results differ in the significant variables (at the 90% level). Income is negative and significant for VMH in trade1 while in trade2 those who are married and those who are female exhibit weaker preferences than those who are not married and those who are male, respectively.[9] Income and education enter positively and significantly in trade3.

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8. Results from table 5-15 include tradeoffs exhibited in other regressions as explanatory variables. This specification has a number of statistical and logical difficulties and so will not be pursued further.

9. Note that table 16 in the VMH report is mislabeled. Trade2 results are actually those for trade3, and vice-versa.

Comparison of predicted VOCBs

With the above regression results in hand and sample means for both the version I and VMH results, we can now compare average VOCBS adjusted for sample differences and model differences (table 5-6). There are four predicted tradeoffs (two regression models * two sets of sample averages) for each of the three trades.

A comparison of the two models holding sample composition constant yields less ambiguous results, however. Using the version I sample, the VOCBs are larger when paired with the version I model than they are when paired with the VMH model, differing by $55,000 to almost $600,000 per case. Also, using the VMH sample, the pairing with the version I model yields higher VOCBs in trade2 ($62313 vs. $602K) and much higher values in trade3 ($1.12 million vs. $445K). Only for trade1 is hypothesis I rejected, i.e., where the VOCB is larger when the VMH sample is paired to the VMH model than when it is paired to the version I model ($54513 vs. $77513).

Using average sample values can be misleading if the distribution of response is very different. To test this we again computed three sets of four tradeoffs, this time predicting tradeoffs from each person in each sample, averaging within the sample and comparing average tradeoffs. With this approach, both average and median VOCBs can be compared. The bottom half of table 5-6 shows that pairing the version I model with the version I sample yields far higher VOCBs than when the VMH model is paired with the version I sample in all three trades and for both mean and median measures. Other comparisons are more equivocal but are in line with those based on average sample characteristics.

Inconsistencies Adjustments

With nearly half of our sample and two-thirds of the VMH sample reporting at least one VMH-inconsistency, it is important, to examine these inconsistencies further. In this section, we adjust the samples to address problems with the inconsistency definitions and the VMH computation

Table 5-6. Comparison of Predicted VOCB for Version I and VMH Samples Paired with Version I and VMH Regression Models, VMH-Consistent Observations Only.

	Trade 1	Trade 2	Trade 3
(millions of dollars)			
Predicted VOCB Using Sample Averages			
Version I Model -- Version I Sample	$0.75	$0.76	$1.06
VMH Model -- Version I Sample	0.69	0.66	0.46
Version I Model -- VMH Sample	0.55	0.62	1.12
VMH Model -- VMH Sample	0.77	0.60	0.44
Average of Predicted VOCBs			
Version I Model -- Version I Sample	$0.84	$0.89	$1.34
Median	0.79	0.79	0.87
VMH Model -- Version I Sample	0.70	0.68	0.48
Median	0.70	0.69	0.39
Version I Model -- VMH Sample	0.74	0.78	1.57
Median	0.62	0.69	0.85
VMH Model -- VMH Sample	0.78	0.62	0.49
Median	0.77	0.61	0.47

Value of Statistical Life = $2,000,000.

program, and compute VOCBs for the version I and VMH sets of samples with these adjustments.

Table 5-7 shows the effects on sample size of including in the sample persons who exhibit certain questionable inconsistencies. For inconsistencies (i) and (iii), a minor error in the VMH computational program permitted several subjects with these inconsistencies to remain in the samples. These subjects are dropped from the analysis.

Inconsistency (ii), indifference to dominated city, while, in theory, a true inconsistency, could have resulted from two types of mechanical errors that would not invalidate such responses: repeatedly hitting the return key after indifference is reached (the cursor is initialized at a point of indifference on all sub-trades so pressing <return> without moving the cursor would have registered indifference continually) or, for those reaching indifference on the last (dominated) sub-trade, not moving the cursor off of its initial point (at indifference) instead of moving it to the dominant city. The latter error is seen, in this light, as a less extreme form of the last ditch switch. Because post-survey briefings indicated the presence of these errors, subjects with this inconsistency were added back into the samples. Subjects reaching indifference on the last subtrade were assigned VOCBs of $8 million or $10,000 ($5,000 for trade3), as appropriate, with others assigned the implied VOCB associated with the risk tradeoff at the subtrade where they first signaled indifference between the two cities. For version I this implies adding seven subjects (3 to trade2 and 4 to trade3) and for VMH, 51 observations were added in total (24, 20, and 7 in tradel, trade2, and trade3, respectively).

As noted above, inconsistency (iv) --the last-ditch switch-- involves a subject who switch cities in the last sub-trade, realizing that his city of initial preference is now dominated by the other city. In fact, the subject may be revealing a tradeoff exceeding that available from the program. With a VOL of $2 million, this implies a VOCB of over $8 million for subjects initially choosing the city with the lower chronic bronchitis risk and a value below $10,000 for subjects initially choosing the city

with the lower auto death risk. Thus, to adjust for this possibility subjects with inconsistency (iv) are added to the version I and VMH datasets and assigned a VOCB of $8 million or $10,000, as appropriate. For version I this implies adding 29 observations over the three trades (13, 6, and 10 in tradel, trade2, and trade3, respectively) and for VMH, adding 133 observations (53, 51, 29).

For inconsistency (v), indifference to all subtrades, some individuals indicating indifference to the initial sub-trade as well as the check question are also defined by VMH as a type (v) inconsistency. As it is possible that individuals could be indifferent to the initial sub-trade, we add such individuals back to both the version I and VMH samples.[10] In all, this implies adding 18 observations to the version I sample (4, 7, and 7 in tradel, trade2, and trade3, respectively) and 55 observations to the VMH sample (22, 24, and 9).

Finally, we identify an additional inconsistency (type vi), termed intermittent indifference. Here, a subject may indicate preference for a given city for some sub-trades, then indicate indifference, then indicate preference for the same city and then indicate indifference. This intermittency may involve more than two inconsistencies. While such responses, as in inconsistency (ii), may involve a cognitive problem and therefore be a true inconsistency, they may also arise because of mechanical difficulties. For instance, a subject may have responded to a sub-trade question by hitting <return> when he meant to move the cursor. To try to distinguish cognitive inconsistencies from mechanical ones, we dropped observations with intermittent indifference only when two or more intermittent subtrades appeared within a tradeoff question. There were only three such subjects in VMH, all in tradel, and none in the version I sample.

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10. Because a subject who was indifferent to the initial question and the check question would be moved by the program to the next set of tradeoff questions, subjects generally would not be given the opportunity to be indifferent to all sub-trades. The only way for a subject to be indifferent to all subtrades is for the subject not to be indifferent to the sub-trade on the check question and then, subsequently, to be indifferent to all sub-trades.

Table 5-8 lists the means and median VOCBs from the three trades for the Version I and VMH samples, first repeating the VMH-consistent set of results, then providing results for the samples with each inconsistency adjusted separately, and then, after making all inconsistency adjustments for the fully adjusted sample (FAS).

Adjusting inconsistencies (ii), (iv), and (v) makes the greatest difference to the VMH-consistent average VOCBs. These differences sometimes reverse the ranking of average VOCBs across the VMH and version I samples. Take the average VOCBs before and after adjusting the sample for inconsistency (iv). The average VOCB in the VMH sample from trade2 changes from $2.46 million using VMH-consistency to almost $4 million after our adjustments. In contrast, the average VOCB in the version I sample for the same trade changes from $3.2 million to $3.56 million. Thus, after adjustment (iv), the VMH VOCB is actually larger than that for version I in t rade2.

After "fully adjusting" the samples, the percentages of the samples with inconsistencies remaining in any one trade fall dramatically, to 11-20% for the VMH sample and to 1-5% for the version I sample. Over all trades, 8 of 95 version I subjects (8%) had at least one inconsistency. The VMH subjects were more inconsistent, 28% (53/194) had at least one inconsistency over the three trades and 17% (68/389) had at least one inconsistency oiler trade1 and trade2.

Using the median VOCB measure of central tendency, the effect of these inconsistency adjustments is to increase VMH median VOCBs somewhat, except in trade2 where there is no change. The version I median VOCBs are also increased, with the exception of trade2. On balance, the VMH sample still yields **a** higher VOCB than that for version I in trade1 and lower values for trade2 and trade3, although the gaps widen for trade1 and trade3.

With respect to mean VOCBs, the VMH fully adjusted sample provides a significantly higher VOCB in trade1 than the Version I fully adjusted sample, with differences in the other trades not significant. This evidence against hypothesis I can be explained, in part, by noting that the

"full" inconsistency adjustments increase average VOCBs far more in the VMH sample than in the Version I sample. Mean "fully adjusted" VOCBs are significantly larger than the mean "VMH-consistent VOCBs for all three trades taken from the VMH sample but are not significantly larger in any of the trades taken from the version I sample. Given the bias towards inconsistencies in the version I sample, this result is either fairly strong evidence against a familiarity effect or an indication of a high degree of cognitive and mechanical difficulties in the VMH sample.

Final Tradeoff Regressions

With the fully adjusted samples identified, the regression analysis to explain the tradeoffs (discussed above) can now be repeated and used to generate adjusted average VOCB estimates. These results are in table 5-9. The regressions generally are less able to explain variation in the tradeoffs than they were for the VMH-consistent samples. Using these results to generate VOCB comparisons for the version I and VMH samples (table 5-10 comparable to those in table 5-6), we find that the familiarity hypothesis receives little support, except for trade3.

A Sensitivity Test

The computation of VOCBs for subjects with valid responses that, nevertheless, reveal indifference to two or more consecutive sub-trades has proceeded above under the convention that the tradeoff (t) is computed at the level of risks associated with the subtrade where indifference was first observed. However, this convention is an extreme one. As the indifference curve for the characteristics being traded-off is vertical at this. point, it is equally justified to compute indifference tradeoffs at the other extreme -- using the risks of the last subtrade where indifference was observed. If the city with a lower rate of chronic bronchitis is initially preferred, adopting the latter convention will result in higher VOCBs than if the former convention is used.

The issue can be addressed in figure 5-4. Here, as in figure 5-1, the individual in trade1 initially favors city B. He indicates indifference to a bundle such as C. But, then he also indicates indifference to a bundle such as D. The implication is that the indifference curve is "thick" in

the region between C and D. VMH use the convention of computing the tradeoff t using the bundles at A and C. Our sensitivity test computes t using the bundles at A and D.

Table 5-11 shows the effects of adopting the latter convention on VOCB both the version I and the VMH samples using the VMH-consistent and the fully adjusted samples. Comparing these VOCBs to those on table 5-8, it is apparent that the mean and median VOCBs are increased dramatically for trade1 but are barely affected for the other two trades.

Regression Tests of Conditional Familiarity

So far, the effect of familiarity on responses has been tested by comparing VOCBs for a sample of relatives of people with chronic respiratory disease to those of people chosen in a shopping mall. The "mall" effect complicates this test. Therefore, we test the familiarity effect with the Version I sample alone by defining familiarity variables and testing their effect on the tradeoffs. The hypothesis tested, however, is somewhat different than that above: those more familiar with a chronic respiratory disease give a higher VOCB than those less familiar (as opposed to the hypothesis that those with any familiarity give a higher VOCB than those with no prior familiarity).

In all, eight familiarity variables were created: RELATE (a dummy variable for whether the relative was a sibling, parent, or child (=1); zero otherwise), TLKOFTEN (the frequency of phone contact), SEEOFTEN (frequency of face-to-face contact), SEETALK (the sum of TLKOFTEN and SEEOFTEN), LIVEWITH (whether the respondent lives with the sick relative; YES = 1), AIJTOACC (whether a friend died in an auto accident; YES = 1), FAM (the respondents rating, on a 0 to 49 point scale, of his familiarity with his relative's disease), and DK (the number of times that the respondent answered "Don' t Know" to questions about his relative's disease). Annex D contains descriptive statistics for these variables.

Additional Variables. Variation in tradeoffs until now has been explained by the list of variables used by VMH. There are several additional variables (beyond familiarity variables) that quite plausibly

could affect tradeoffs. These include WORK (whether the individual works outside the home), EXERCISE (the hours of strenuous exercise per week), COLD (whether the respondent ever had a bad chest cold), SELFRISK (whether the respondent believes that he has a greater risk of developing lung disease than the average person), DRIVER (whether the respondent is typically the driver or the passenger in a vehicle), MILES (miles traveled per year), and INSURNCE (whether the respondent or other family member has more than $20,000 of life insurance per year). Summary statistics for these additional explanatory variables are also in Annex D.

Explaining tradeoffs. Regressions to explain the log of tradeoffs were run for the set of initial and additional explanatory variables plus the AUTOACC variable (in trade1 and trade2) plus each familiarity variable in turn. Two data sets were used: the VMH-consistent sample and the fully adjusted sample. Table 5-12 provides examples of the results.

The results were quite consistent across all regression sets. Those more familiar with their relative's disease tended to place a higher value on avoiding the abstract case of chronic bronchitis than those less familiar with the disease, but the familiarity variables were generally insignificant. For the VMH-consistent sample, only four of 21 regressions (the variables for frequency of contact and the whether you lived with your relative) yielded positive and significant coefficients on a chronic bronchitis familiarity variable, all for trade2. For the fully adjusted sample, only AUTOACC even approached significance. Thus, among individuals familiar with chronic lung disease, in the sense that they have a relative with the disease, the degree of familiarity as we measured it does not appear to have a strong, consistent effect on tradeoffs involving the abstract chronic bronchitis case.

Three of the additional explanatory variables had more consistent and significant effects on the tradeoffs. Most clearly, those engaged in more frequent strenuous exercise generally placed a greater value in avoiding chronic bronchitis, whether it meant giving up income or bearing greater auto death risk. Intriguingly, those who had experienced a cold or other respiratory effect restricting their breathing placed a lower value on

reducing chronic bronchitis risk. Also, as might be expected, those with larger life insurance policies tended to place a lower value on reducing risk of accidental death. A fourth variable, SELFRISK, was consistently negative and significant for trade2 but positive and more significant for trade3. Thus, people believing themselves to be at greater risk than the average person in developing chronic bronchitis tended to vary their preferences, depending on the nature of the tradeoff. They placed a lower value on obtaining risk,reductions in chronic bronchitis when accepting higher auto death risk, but a higher value when it meant reducing income.

Conclusion

Familiarity appears to affect average and median VOCBs, with those who have relatives with chronic lung disease (version I) generally bidding higher than those who (generally) do not (VMH), correcting for differences in sample characteristics. This is particularly true when reduced risk of chronic bronchitis is being traded for a higher cost of living and for samples that have been culled of responses exhibiting "VMH- inconsistencies; " this is less true with the “fully adjusted samples,,, where many of these individuals have been added back in.

Within the version I sample, where all individuals are familiar with chronic lung disease but the degree of familiarity varies, familiarity does not appear to affect a person's VOCB.

HYPOTHESIS II

The second hypothesis is that respondents familiar with a more serious case of chronic lung disease will place a higher value on reducing their own risk of developing ,,a disease like their relative's,, than those familiar with a less severe case. Because the severity of the case being valued varies for each person (subjects were asked a series of questions about the severity of their relative's disease before answering the tradeoff questions), this hypothesis can be tested directly using responses from the version II questionnaire. Because the disease being valued may be any type of chronic respiratory disease, the term “value of a statistical case of chronic lung disease,, (VOCL) is used instead of VOCB.

The role of severity in interpreting tradeoff responses for version I is quite different than for version II. The sample receiving version I was not asked severity questions until after the tradeoff questions were completed. Indeed, their ill relative was not even mentioned until after the tradeoffs were made (although the screening questions read to them over the phone asked about their relative's illness). Therefore, if respondents were answering the tradeoff questions on the basis of the description of the abstract case of chronic bronchitis, we would expect that there would be no statistical relationship between their tradeoffs and the severity of their relative's disease. To the extent that such a relationship is found, it may indicate that respondent's were unable to divorce themselves from their relative's case.

Severity Defined

The severity of respiratory diseases is measured in several different ways. Standard questions meant to measure severity were taken from the British Medical Questionnaire (BMQ) and similar questionnaires. These questions measure the severity of cough, wheezing, pleghm, and breathlessness. As seen in annex F, several questions are asked about each symptom that help rate its severity. From these, one severity measure was created for breathlessness and two measures each were created for cough, phlegm, and wheeze. For breathlessness, the respondent is confronted with a series of progressively easier breathing situations, from walking uphill to getting dressed, and asked which of these his relative has trouble doing. A breathless score is then assigned depending on how many of these situations do not give the respondent trouble. The two measures for each of the other symptoms are (1) a dummy variable for the symptom being present or absent, e.g., COUGH1, PLEGM1, and (2) an ordinal variable for severity as defined by the BMQ, e.g. COUGH2. In addition, we asked a question about whether the relative was hospitalized in the last year (RELHOSP). The final variable (SEVSUM) was the number of symptoms, therapies, and lifestyle effects (out of 13) that were present as part of the relative's condition. These components of SEVSUM are highlighted in annex A.

As the full model specification to explain variation in VOCLs must incorporate both severity and familiarity variables, it is appropriate to ask whether these two classes of variables are collinear. We find (see authors) that no Pearson correlation coefficients exceed 0.4 in either version I or II for either the VMH-consistent of the fully adjusted samples. In addition, none of the variables causes significant degradation of estimated coefficients according to the Belsley, Kuh, and Welsch (BKW) test.

Version II VOCL.

Table 5-13 presents mean and median estimates of VOCL obtained from the version II sample. Two sets of results are provided, one set for the VMH-consistent sample and one set for the fully adjusted sample (FAS). Median VOCLs for the VMH-consistent sample range from $1 million to $1.6 million (using a VOL of $2 million for converting the risk-risk tradeoffs on trade1 and trade2 to dollars) with from 25 percent to 36 percent of the sample having VMH-inconsistencies. The FAS exhibits larger median VOCLs, ranging from $1.6 million to $2 million.

Explaining variation in VOCL (version II).

Regressions to explain the tradeoffs were run for each of three trades for the two samples, using the "standard" set of explanatory variables plus each severity variable in turn. Then, the best performing severity variables were paired with the best performing familiarity variables to run the final set of regressions for this hypothesis test.

Table 5-14 presents representative results of these final runs. The signs on the severity and familiarity variables are generally correct but few are significant at the 90 or 95% level. In this regard, the fully adjusted sample yields more significant results than the VMH-consistent sample. In general, people who do not live with their sick relatives (LIVEWITH = 0) and those whose relatives have more of the symptoms checked off in the questionnaire (SEVSUM) value risk reductions in a chronic lung disease "like their relative's" more than those who do live with their relatives or have relatives with fewer symptoms.

The results associated with the **LIVEWITH** variable, and well as other familiarity variables need to be emphasized. For version I, the conditional familiarity effect appears to be positive (but not often significant), i.e., that greater familiarity results in a HIGHER VOCB. For version II, we find the opposite, i.e., that greater familiarity reduces average VOCL. Additional information on the familiarity effect when the two samples are pooled is discussed below.

Version I. Severity should not influence version I tradeoffs if all respondents reacted to the same abstract case of chronic bronchitis. As shown in table 5-15, severity apparently did affect tradeoffs. With regression results for version I using the **WHEEZE2/SEEOFTEN** combination for illustration, it can be seen this "best performing" combination is more robust than severity/familiarity variable combinations for version II, with the WHEEZE2 variable being significant and positive at the 97% level for trade1 and trade2.

A broader comparison of results indicates that the severity of the relative's disease has somewhat more robust effects on version II responses than on version I responses. Table 5-16 summarizes all of the regression results for the severity variables, by version and sample, according to whether the coefficient had the correct sign, whether, in addition, it was significant at the 90 or 95 percent level, and whether it was significant at the 90 percent level but with the wrong sign. The most striking differences between the version I and II samples are (1) the appearance of wrongly signed and significant severity variables for version I only and (2) the much higher percentage of correctly signed variables for version II. In the other two categories, severity appears significant and positive more often for the version II sample when fully adjusted responses are being compared, but less often when the VMH-consistent responses are being compared.

These results have two mutually exclusive interpretations. On the one hand, they may indicate that the severity of a case of chronic disease does influence WTP, but as currently designed, the questionnaire and protocols are not successful at focusing respondents on an abstract case of chronic

disease. On the other hand, the results may simply indicate that the severity variables either fail to capture severity very well or a severity effect is not present and what is being identified as an effect is statistical noise. The latter interpretation is less compelling, however, when the same severity variable is found to be significant over two or three trades (for the same sample).

Hypothesis III

This section examines whether reductions in risks of contracting an abstract case of chronic lung disease (the VMH chronic bronchitis description) are valued less than such reductions of a concrete case (the respondent's relative's disease) of chronic lung disease, holding severity constant. The test is whether Version II VOCLs exceed those of Version I after the severity adjustment. In spite of the results of the hypothesis II tests, where, according to one interpretation, tradeoffs offered by Version I respondents may have been influenced by the severity of their relative's illness, there may still be a difference in the average VOCLs across the versions that is attributable to the abstract case format of version I and the specific case format of version II.

To test hypothesis III, two comparisons are made. First, median VOCLs are compared across versions, implicitly correcting for severity differences. Second, a statistical correction for severity differences is made in a regression pooling responses to both versions of the questionnaire.

Version I and Version II VOCLs Compared

As the version I and version II samples were chosen randomly from the pool of respondents to our ad, and the measured sample characteristics are quite similar, the only major difference between subjects in these samples is the severity of the cases being valued and their abstract versus concrete nature. Severity differences can be corrected if the SEVSUM variable can be assumed to reliably capture severity. This variable sums YES (=1) responses to the presence of 13 characteristics of chronic lung disease. Those in version I were simply told that each one of these

characteristics was present in the abstract case to be valued. Thus, SEVSUM = 13 for all subjects taking version I of the survey. Respondents given version II were asked which of the 13 applied to their relative and given the appropriate score. It follows that the abstract case of version I is more severe than the concrete cases of version II unless a latter case receives a score of 13. By dropping individuals who reported such a score from the version II sample, average VOCLs can be compared across the versions to test hypothesis III.[11] As severity is now greater for the version I case than in any of the remaining version II cases, evidence for hypothesis III is present if the version II average VOCL exceeds that of version I.

Comparisons of median VOCLs made for VMH-consistent samples and the fully'adjusted samples (with individuals dropped as appropriate) support hypothesis III. From table 5-17 in 5 of 6 comparisons (all three VMH-consistent trades), the median VOCL for Version II exceeds that from Version I ($1.6, $1.6, $1.1 million for Version II versus $0.53, $0.80, $1.1 million for Version I), while for the fully adjusted sample, all median VOCLs for version II exceed their version I counterparts ($1.6, $2, $2 million for version II versus $0.67, $0.80, and $1.6 million for version I). All mean VOCLs are larger for version II, although only the mean VOCLs for trade2 of the FAS are significantly different across versions.

These comparisons ignore possible differences in sample characteristics. A more powerful statistical test is to pool responses to both versions, including familiarity and severity variables. By including the severity variable SEVSUM (defined as above), severity is corrected for. Thus, a dummy variable (DUMMY=1 for version I, zero for version II) can

11. Version II respondents were asked two additional questions about disease characteristics: whether their relative died prematurely because of their chronic illness and whether their income was affected (these possibilities were explicitly ruled out in the version I questionnaire). Individuals answering YES to either question were also dropped from the version II sample.

represent the distinction between the specific and the abstract case of chronic illness.[12]

Table 5-18 indicates that there is strong evidence for an abstract-specific case effect for trade3 (a negative sign on DUMMY indicating that version I tradeoffs were below those of version II), but very weak evidence for this effect in trade1 and trade2. On possible explanation for this difference is that the abstraction "death in an auto accident" is a part of the tradeoff decisions in trade1 and trade2 in both versions, but the relatively concrete "cost of living" is being traded off in trade3.

Some collinearity between with DUMMY and RLOSEINC and RSHLIFE exists. To test the effects of including all three variables on the DUMMY, these variables were dropped. DUMMY became significantly negative more often.

The above use of the modified SEVSUM variable to correct for severity differences may be objected to because, in the tests of hypothesis II, it was found that the severity of a relative's disease may have influenced tradeoff responses for the version I sample (contrary to expectations). Assuming that this effect is a true effect, one of the standard severity variables (WHEEZE2) is substituted for the modified SEVSUM variable in the pooled regressions, the variable ALIVE (is your relative living?) is substituted for RSHLIFE, and RLOSEINC is dropped. The results, in table 5-19, are that DUMMY is negative and significant for both samples in trade1 and trade2 but not trade3 and WHEEZE2 is positive and significant in most of the trades.

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12. Again, two additional variables were added to the regressions: a variable for whether the version II respondent's relative died prematurely (actually these responses overlap perfectly with the answers to the question of whether the relative was dead) (RSHLIFE = 1 if relative is thought to have dies prematurely because of his disease) and a variable for whether the relative was thought to have lost income as a result of their disease (RLOSEINC = 1).

CONCLUSION

For the respondents sampled, the value of avoiding a statistical "abstract" case of chronic bronchitis appears to be less than the value of a statistical life, although many respondents view developing a case of chronic bronchitis of the severity described to them as "worse than death." When faced with a tradeoff between chronic bronchitis risk reductions and a higher cost of living, median VOCBs are in the range of $1 million to $1.6 million.

These numbers should be viewed with some caution, however, as there are numerous apparent or real inconsistencies in the choices made by individuals in the sample. Owing perhaps to the more controlled environment in which our surveys were given or to the payments that were given to participants, our rates of inconsistencies are lower than those found by VMH, however. Approaches to reduce inconsistencies are examined below.

Considering the hypothesis tests, noise in the data, measurement problems for familiarity and severity, and the fact that each variable was tested in each of three trades, conspire to limit the robustness of our results. Nevertheless, the following conclusions can be offered:

Hypothesis I: familiarity of an unconditional nature--when comparing VOCBs of those who have relatives with a chronic lung disease to those that, for the most part, do not--appears to increase average values, particularly for the risk-income tradeoff. Conditional familiarity, i.e., the degree to which a person is familiar with chronic lung disease given that they are familiar, does not appear to affect VOCBs.

Hypothesis II: when a group of individuals is considering risks from a disease "like your relative's" (rather than an abstract case of chronic bronchitis), those whose relatives have more severe cases of chronic lung disease tend to bid higher for risk reductions than those whose relatives are less ill, although few measures of severity were significant.

Hypothesis III: when a disease "like your relative's" is substituted for the abstract case of chronic bronchitis (in a version of the survey given to a new, but very similar sample), the median and mean VOCBs tend to be larger for both the risk-risk and risk-income tradeoffs, even correcting for differences in disease severity and even allowing for the possibility that respondents to the abstract case tradeoffs may have been influenced by the severity of their relative's disease. Thus, posing tradeoffs in terms of abstract cases of disease yields lower VOCBs than when posed in terms of concrete cases.

Many of the more quantitative conclusions of this analysis can be summarized by considering the summary pooled regressions in column 6, table 5-18. When confronted with moving to one of two cities, one with a lower cost of living than the other but with a higher risk of contracting either an abstract case of chronic bronchitis or a specific case of chronic lung disease, respondents tend to give up more income for lower health risk when :

- the case is specific rather than abstract
- the case is more severe (as measured by SEVSUM)
- if the ill relative is alive

and if the respondent:

- feels himself to be at greater than average risk of developing a chronic illness
- has relatively large amounts of life insurance
- has recent experience with a cold that made breathing difficult
- does not (or has never) smoke (indicates greater value placed on good healthr militancy towards right to smoke)
- is older (90% level)
- lives in a larger household
- is female

What of the magnitude of these effects? For trade3 in 5-18, asking about a **real (as** opposed to an abstract) case of chronic illness raises

VOCLs by $400,000 over asking about an abstract case; if the relative is alive the VOCB is $250,000 larger; being female, having a relative with three (of 13) points higher on the SEVSUM scale, or thinking yourself at greater risk of getting chronic lung disease adds $200,000 to the VOCB, having more than $20,000 in life insurance adds $170,000, while having a cold is equivalent to not smoking, which adds $160,000 each. Interestingly, both conditional familiarity and income effects are zero.

What of the future of the VMH approach to eliciting WTP? We feel that this approach represents an important and useful means of obtaining WTP estimates for a variety of non-market commodities and strongly endorse its continued use. Our experience with this survey instrument and its modification leads us to several suggestions for further development of the approach:

(i) the survey needs to incorporate more opportunities for learning about the logic underlying the tradeoff task. At present, the number of subjects with cognitive inconsistencies is too large to provide reliable estimates of such tradeoffs. Adding a mock tradeoff scenario with interactive feedback when answers are inconsistent would facilitate the learning process.

(ii) opportunities for mechanical inconsistencies should be reduced. For instance, if the cursor indicating strength of preference were not placed initially at indifference but was placed somewhere off of the preference line, the number of inconsistencies would undoubtedly be reduced.

(iii) the order of the tradeoff questions should be randomized to identify and be able to correct for the effect of learning on tradeoffs.

(iv) the effect of alternative step sizes between subtrades should be investigated.

(v) more attention needs to be paid to the paths taken by subjects to reach indifference, both to more closely examine irrational behavior

patterns and to understand and possibly categorize responses. Considering irrational behavior, even among those whose responses passed the consistency tests, there were many instances of such behavior, e.g., preferences for a given area changing from slight preference to strong preference even as the the area's attractiveness diminished for subsequent subtrades. Considering categories of responses, we note that there are a group of "all or nothings" (those who strongly prefer one area and then strongly prefer the other) and "marginalists" (those whose preferences weaken gradually with the diminished attractiveness of an area).